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Socio-communicative aspects of artificial intelligence use in information systems

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Abstract. The study aimed to examine the use of artificial intelligence in the media and explore its ethical implications. The methodology encompassed theoretical analysis, media studies, expert evaluation, content analysis, sociological surveys, and comparative analysis. The research focused on the impact of AI on journalism, particularly in content creation, fact-checking, and the ethical considerations of integrating emerging technologies into journalistic practice. Various aspects of AI applications in the media were analysed, including using tools such as ChatGPT, Logically, and Factmata for text generation and combating fake news. One of the key findings was the determination of the frequency of AI-generated content consumption and the assessment of audience trust in such content. The analysis of the advantages and disadvantages of AI revealed that its primary benefit lies in the speed of content creation, while its main drawbacks include a lack of analytical depth and the potential for errors. Findings from the sociological survey and content analysis confirmed that AI can significantly enhance the efficiency of routine tasks, such as fact checking, but cannot fully replace traditional journalism, particularly in the production of complex analytical materials. Respondents viewed the use of AI for fact-checking positively but expressed concerns regarding potential job losses among journalists. The practical significance of the socio-communicative aspects of AI use in journalism and the media is considerable within the information landscape, as AI integration facilitates content creation, dissemination, and analysis while enabling media organisations to adapt to audience needs

Keywords: media companies; social interaction; access to resources; algorithms; dynamics

Introduction

Artificial Intelligence (AI) has become an integral part of information systems, significantly altering approaches to organising social interaction and communication. The implementation of machine learning algorithms, neural networks, and natural language processing has enabled information systems to analyse vast amounts

of data, adapt to user needs, and automate information exchange processes. This creates new conditions for interaction between people, as well as between people and technology, which significantly impacts social and communication processes. The application of AI in communication systems contributes to the optimisation of

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information processing, content personalisation, and improved interaction efficiency. Journalism has also undergone significant changes due to the introduction of AI technologies. Chatbots and virtual assistants have become important tools for automated audience service. They enable automated responses to reader queries, news delivery, and user interaction, ensuring effective customer relationship management. AI-powered platforms, in turn, analyse user behaviour, studying their interests and habits, allowing for the development of personalised engagement strategies. This enables media organisations to not only improve reader interaction but also create content tailored to their tastes and needs. Additionally, AI technologies can assist in the automated creation of news content, particularly for the rapid processing of large amounts of information, significantly increasing journalists' efficiency. However, AI also poses risks related to data ethics, privacy, and potential impacts on social relationships. Algorithms can exacerbate information inequality, foster biases, and undermine trust in communication channels.

A significant number of researchers are studying this topic and present various perspectives. For instance, O. Iaroshenko (2024), S. Domashenko (2024) examined the impact of new technologies on journalism, particularly the role of artificial intelligence in the media industry. She drew attention to the transformation of the journalist profession amid technological changes and the new challenges arising from the implementation of these innovations. Her research focuses on how artificial intelligence is changing news production and on identifying potential social and ethical implications of these changes for professionals and audiences. The research by M. Spring *et al.* (2022), F. Ioscote *et al.* (2024) covered academic publications related to artificial intelligence in journalism. The authors explored how technologies are changing the socio-economic landscape of media and investigated the technical and social challenges journalists face in the context of digital transformations. These transformations include the automation of content creation, the shift to digital platforms and social media, content personalisation, and the use of artificial intelligence algorithms for analysing and disseminating information.

Specifically, M.-F. de-Lima-Santos & W. Ceron (2021) focused on examining journalists' perceptions of artificial intelligence, analysing the opportunities and threats associated with its use in media. Their research also included assessing journalists' attitudes towards such technologies, and determining how they can aid in news production while simultaneously raising ethical and professional concerns. The research by V. Moravec *et al.* (2024) concentrated on analysing the perception of artificial intelligence in journalism from a socio-economic perspective, specifically examining how the development of this technology can impact the media landscape, and attempting to forecast potential scenarios of digital technology's influence on the future of journalism. S. Mahony

& Q. Chen (2024) focused on analysing concerns related to the use of artificial intelligence in journalism. Additionally, the aforementioned researchers identified potential media manipulation and risks arising from the automation of content creation, raising important ethical questions concerning the accuracy and impartiality of news.

H. Cools & N. Diakopoulos (2024) explored the role of generative AI in newsrooms, assessing how journalists perceive the potential of these technologies for news creation. Their research encompassed the challenges and risks arising from the adaptation of these innovations within the professional activities of journalists. The findings of A. Noain-Sánchez (2022) highlighted the impact of AI on journalism through the lens of experts, journalists, and academics, analysing how these groups perceive new technologies and how AI can transform not only journalistic practices but also its ethical norms and professional standards. S. Parratt-Fernández *et al.* (2021) investigated the application of AI in journalism, specifically how AI influences news production processes and journalistic practices. They also analysed academic literature on this topic, identifying key research areas and new trends in technology use. The authors emphasised the ethical issues and challenges arising from the integration of AI into the media environment.

Research in journalism and media studies has identified gaps in understanding the influence of social and cultural factors on the implementation of artificial intelligence in information systems, as well as the adaptation of such technologies within media organisations. Many studies have insufficiently focused on the practical aspects of AI integration in real-world settings, particularly in the context of ongoing technological changes in the media environment. Moreover, there is a lack of research on the unequal access to AI in different regions and its potential impact on education, information accessibility, and social dynamics within the media landscape. For instance, different countries may have varying levels of technological access, influencing media literacy and the ability to critically evaluate AI-generated news.

Additionally, there is a dearth of in-depth analysis of the ethical implications associated with the use of AI in journalism. Issues such as algorithm transparency, accountability for automated news, risks of content manipulation, and potential biases remain under-researched. The integration of AI into media systems requires a systematic approach to its adaptation in various fields, specifically regarding how technology impacts journalistic practices, the ethics of news creation, and information flow management. This study aimed to highlight the role of artificial intelligence in journalism and media, and the ethical challenges arising from the integration of new technologies into the media environment.

Materials and Methods

The research combined theoretical analysis, media studies, and expert evaluation. The timeframe covered

the period from 2010 to 2024, allowing for tracking the implementation and evolution of artificial intelligence in journalism. Data collection involved analysing academic articles, media reviews, and reports on AI applications in journalism. Databases such as Scopus and digital archives of media companies, including Automated Insights, Reuters, and the Center for Journalism Innovation, were utilised. Examples of AI algorithm applications in content creation, such as ChatGPT, and systems for verifying fake news, including Logically and Factmata, were analysed. Content analysis, sociological surveys, and comparative analysis were employed during the research. Content analysis was used to examine instances of AI in text generation and news verification. Sociological surveys determined the impact of algorithms on audience perception. The sample for the sociological survey was selected using a random sampling method, ensuring the representativeness of the results

for the general media audience. The survey involved 200 respondents, evenly divided between 100 women and 100 men aged 20 to 45. Survey results were processed using statistical methods, including descriptive statistics, to determine mean values, frequency distributions, and percentage breakdowns of responses. Data was presented in tables and graphs for clarity. Assessing the level of trust in AI-generated content and identifying its advantages and disadvantages was achieved through analysing responses to closed-ended survey questions. Adhering to the ethical guidelines of sociological research, all respondents participated voluntarily, and their responses were kept confidential and anonymous. Participants were informed about the purpose of the study, and their responses were used solely for research purposes (American Sociological Association, 2018). Questions were formulated to cover key aspects of media consumption and perception (Table 1).

Table 1. Main aspects of media consumption and perception

Category	Question
Frequency of content consumption	How often do you interact with content created using AI (news, articles, videos)?
	Do you differentiate between AI-generated content and content created by humans?
Trust level	How much trust do you place in information created by AI compared to traditional journalists?
	Does knowing that the content was created by an automated system affect your trust in it?
Advantages and disadvantages of AI-generated content	What positive aspects of AI-generated content do you notice (speed of creation, objectivity, accessibility)?
	What negative aspects do you observe (lack of in-depth analysis, possible errors)?
Ethical aspects	What is your opinion on the use of AI in creating media content?
	Do you believe that automation in journalism reduces the role of human journalists?
Future of content	In your opinion, can AI-generated content completely replace traditional journalism?
	Do you support the idea of integrating AI for factchecking or combating fake news?

Source: created by the authors

The research integrated a structured approach that combined content analysis, audience impact analysis, and ethical considerations. A synthetic approach was used to compare the application of AI across different countries and media sectors.

Results

The role of artificial intelligence in the transformation of information systems and its impact on information accessibility for different social groups. One of the most notable examples of the transformation of information systems is ChatGPT, used for text generation, as well as fact-checking systems like Logically and Factmata (Nesta, 2024). Research focuses on the application of AI algorithms in the context of media and journalism, and on studying their ability to enhance the efficiency of media companies and ensure the accuracy of disseminated information. ChatGPT's ability to generate high-quality text based on given prompts makes it useful for journalists who can use it to prepare articles, news reports, or even analytical materials. For instance, ChatGPT can help create a first draft, which journalists can then refine by adding their own analysis and unique

interpretations. This process significantly speeds up content creation, reducing the time spent on initial material preparation. However, while ChatGPT can be useful for creating basic texts, it is important to consider that this tool cannot always correctly interpret complex contexts or be capable of critical analysis of information. Therefore, it is essential for journalists to verify and correct the resulting texts, especially when dealing with content that requires a high level of accuracy and precision.

Another crucial aspect of AI utilisation is automated fact-checking systems, which are gaining popularity in the fight against misinformation. Systems like Logically and Factmata have been developed to detect fake news and verify the accuracy of information disseminated through social media and news platforms. Logically employs sophisticated AI algorithms to analyse vast amounts of text and identify potential manipulations or false claims. This system uses databases containing verified information to compare facts with those found in the news or articles being checked. It also analyses the context in which the information was presented to detect potential falsifications. Factmata operates on a similar principle, analysing headlines, text fragments,

and sources used in news articles. These systems are used by media companies as they allow for the automation of factchecking, which is particularly important in an environment where the volume of news is constantly increasing. However, despite the high efficiency of such systems, they cannot always guarantee 100%

accuracy in fact-checking, and therefore, in most cases, their use should be supplemented by human oversight and analysis. For a better understanding of the use of AI in journalism, particularly in content creation and fact-checking, Table 2 provides a comparison of different technologies.

Table 2. Comparison of AI methods in content creation and fact-checking

Method	Description	Example technology	Advantages	Limitations
Content creation	Text generation based on input queries	ChatGPT	Speed of text creation, convenience	Not always able to account for context
Fact-checking	Automatic verification of information accuracy	Logically, Factmata	Fast verification, convenience for media	Requires human oversight
Content analysis	Analysis of audience reactions to content	Specialised algorithms, such as Wordsmith, Media Bias/Fact Check	Understanding audience needs, accuracy	Dependent on data, not always accurate

Source: created by the authors

To better understand the impact of artificial intelligence on audience perception of media content, Table 3 presents the survey results and analysis of respondent answers. This allowed an assessment of how frequently

consumers interacted with AI-generated content, their level of trust in such information, and the advantages and disadvantages they noted when consuming automated content.

Table 3. Survey results and analysis of respondent answers

Question	Responses	Percentage	Interpretation
1. Frequency of consumption of AI-generated content	Daily or several times a week	55%	Most respondents actively engage with AI-generated content, indicating its popularity and availability
	Less frequently, a few times a month	40%	Some respondents still prefer traditional sources of information or encounter automated content less often
	Almost never	5%	A small minority of respondents rarely interact with such content, possibly due to doubts about its quality or reliability
2. Trust in AI-generated content	Completely trust	23%	Only a small percentage of respondents consider AI-generated content to be reliable and trustworthy, indicating some scepticism towards such technologies
	Mostly trust but with caution	57%	The majority of respondents exhibit some distrust or caution, as they believe AI may be unreliable on complex or sensitive issues
	Do not trust	20%	A relatively small portion of respondents express complete distrust towards AI-generated content due to potential errors and lack of depth
3. Advantages of AI-generated content	Speed of creation, objectivity, accessibility	62%	The advantage of speed and accessibility is evident to most, as AI allows for the rapid generation of news and other materials without human delay
	Lack of depth, errors	71%	A large number of respondents highlight the lack of in-depth analysis and the likelihood of errors, which are the main drawbacks of automated content
4. Ethical aspects of AI usage	Positively view the use of AI in journalism	42%	A smaller proportion of respondents consider the use of AI in journalism beneficial, seeing it as useful for automating routine tasks such as factchecking
	Do not support due to the threat of job loss for journalists	58%	Most respondents are concerned about the potential reduction in journalists' roles due to automation, which could lead to job losses
5. The future of AI-generated content	May fully replace traditional journalism	21%	Only a small proportion of respondents believe that AI could replace journalism, emphasising the importance of human involvement in complex journalistic tasks
	Support the integration of AI for fact-checking	79%	A large portion of respondents supports the idea of using AI for factchecking or combating fake news, indicating approval for the automation of this area

Source: created by the authors

The results of the sociological survey highlighted several advantages and disadvantages of automated news creation, particularly concerning the use of artificial intelligence in the media sector. One of the main

advantages of automated news creation is speed. According to the survey, most respondents noted that AI significantly accelerates the process of creating and distributing news. This is a critical factor in the fast-paced

world of news, where obtaining up-to-date information in near real-time is essential. AI algorithms can process vast amounts of data instantly, allowing them to quickly generate news in a short amount of time. As a result, media organisations are able to provide timely information to their audiences without delays.

Another advantage is objectivity, often attributed to AI-generated content. Algorithms can filter out personal biases or emotions that may influence journalists, presenting facts without subjective colouring. This can lead to more balanced and unbiased information, which is important in today's media landscape where it is often difficult to distinguish fact from opinion. On the other hand, the survey revealed several drawbacks to automated news generation. One of the biggest drawbacks is the lack of depth of analysis. Respondents noted that AI-generated news often lacks sufficient context or in-depth coverage of the topic. Algorithms can quickly process large amounts of information, but they cannot understand all the nuances and complexities of a situation. This leads to superficial coverage of events without detailed analysis (Patriak, 2024).

It was also found that automated systems can often make factual errors, increasing the risk of spreading misinformation. Since AI is incapable of critical thinking, there is a possibility that the content will contain errors or inaccuracies that may not be detected in time without human intervention. This calls into question the credibility of news generated in this way. Specifically, the survey showed that respondents have less trust in news created by AI than in material prepared by humans. This is a significant aspect, as trust is one of the key factors in the perception of media content. Many consumers feel that the absence of a human element in the news creation process reduces its credibility, as it is difficult to believe that an automated system can accurately assess a situation or provide context for a news story. Therefore, while the advantages of automated news generation include speed and objectivity, there are also significant drawbacks, such as a lack of depth of analysis and the possibility of factual errors, which reduces trust in the content. This highlights the need for a balanced approach to the use of AI in journalism, where it is important to combine the speed and efficiency of technology with the quality and accuracy of information.

Analysis of companies using artificial intelligence in information systems and identification of common trends and divergences. A significant aspect of this analysis was the study of the quality of generated content and the effectiveness of automated systems in fact-checking and combating fake news. One example of such research is the work of the Center for Journalism Innovation, which conducted a comparative analysis of automated news generation systems, such as Automated Insights' Wordsmith, and traditional journalism methods. Wordsmith is a tool that uses artificial intelligence

to automatically generate text based on data (Legal Tech..., 2024). This platform can be used to create news based on statistical data, which is particularly useful for topics such as finance, sports, and weather. The study showed that automated systems significantly accelerate the news creation process, providing high productivity when working with large volumes of data. At the same time, the research revealed that texts created using such tools may lose contextual connections and be less emotional and detailed, which is a significant drawback compared to human authorship.

Another example is a study conducted by the City University of London, which analysed the use of artificial intelligence for automated news generation (City University of London, 2023). This research compared texts written using the Arria NLG (2024) system and traditional media journalists. The analysis showed that automated systems are effective for creating news content based on facts (such as sports results or financial reports), but they are unable to generate deep context or cover complex social or political issues at the level of human journalism. Thus, while automated systems can reduce the time required to create news, they do not replace the need for human analysis and creativity, especially when it comes to news that requires interpretation, investigation, or coverage of emotional aspects.

Furthermore, a study by J. Granger (2019) showed that the use of automated technologies for news generation has significant advantages in a highly competitive news market. Specifically, such technologies allow media companies to respond quickly to events and publish news rapidly, which is crucial in today's information-saturated environment. However, despite the high speed of content creation, automated systems still cannot replace journalists in terms of in-depth analysis and context exploration, which are essential for comprehensive coverage of complex events. A similar study conducted by Columbia Journalism University (Automated Journalism, 2024) explored the impact of automated news generation on content quality and accuracy. This research found that automated systems can be useful for processing large volumes of data, such as financial reports, sports events, or weather forecasts. However, AI systems are unable to conduct in-depth fact-checking, making them less effective than traditional journalists in combating fake news and misinformation. Additionally, automated systems were less effective at creating texts that convey human emotions and allow for a deeper understanding of social or political issues.

According to research conducted by the MIT Comparative Media Studies (2024), the use of automated systems can be important for ensuring a fast news cycle and processing large amounts of data. However, in the context of factchecking and combating misinformation, it is necessary to combine technology with human intervention. Specifically, they recommend using AI for initial fact-checking and preliminary analysis, followed by

involving journalists for deeper verification and contextualisation of information. Based on the research conducted, several advantages of automated news generation can be identified. These include: the speed of news creation, the ability to process large amounts of data, and reduced costs for creating standard content (such as sports results or financial overviews). However, among the disadvantages, one can note the lack of human interpretation, a reduced ability to conduct in-depth analysis of social and political issues, and the risk of spreading low-quality or unverified content, which can lead to misinformation.

Ethical aspects of ai in journalism. One of the primary aspects to consider when implementing AI in journalism is the ethical implications related to the autonomy of technology and AI decision-making. It is clear that media companies must establish clear ethical frameworks for the use of AI, especially in the context of automated content creation and fact-checking. This will help prevent violations of fundamental journalistic principles such as accuracy, objectivity, and accountability. Based on the research, recommendations can be formulated to help companies adhere to ethical standards and balance technological advantages with the responsibility for creating reliable content.

During the automation of news creation, it is crucial to maintain human oversight to prevent manipulation and misinformation. While AI can rapidly generate large volumes of content, only humans can fully grasp the context and incorporate essential ethical and cultural nuances critical to the news environment. Utilising AI for data processing and fact-checking enables journalists to respond to events more quickly, but it's imperative not to rely solely on automated systems. Research into audience interactions with AI-generated content allows media companies to develop new approaches. By identifying patterns in audience perception, media platforms can be more precisely tailored, and journalistic practices can be adapted to meet specific audience needs. For instance, analysing user reactions to different types of content can help create news stories and articles that better align with readers' interests, thereby improving communication effectiveness. Regarding the ethical use of AI in journalism, it is particularly important to utilise these technologies for automated fact-checking. In an environment characterised by an ever-increasing volume of online information, AI can significantly reduce the time required to verify the accuracy of facts. However, AI may make mistakes when recognising complex contexts or inadequately convey certain social or cultural aspects, thus necessitating human oversight to ensure adherence to ethical standards. Therefore, to ethically use AI in journalism, clear guidelines must be developed to balance technological capabilities with the responsibility of creating accurate, objective, and ethical content. An approach to adapting journalistic practices in light of new technologies should include a quality control system for content

and proper monitoring of the use of automated systems to avoid negative social and cultural consequences.

Discussion

This research examined the socio-communicative aspects of using artificial intelligence in information systems. Given AI's profound impact on all aspects of society, it was essential to understand how these technologies shape social processes and identify potential risks or benefits. The research demonstrated that the implementation of AI can have both positive and negative consequences for social communication. While automation can reduce task completion time, it can also lead to decreased levels of personal interaction, impacting social interaction. The research results align with those of other scholars who have also focused on the social and communicative aspects of AI implementation. For example, D. Elliott & E. Soifer (2022), J. Hohenstein *et al.* (2023) highlight the importance of integrating AI into the media sphere, which can alter the social roles and interactions of journalists in the workplace, influencing the ways news is produced and consumed. They emphasise that automation not only increases efficiency but also changes social relationships within media companies. This aligns with the results of this study, which also showed that automation of media processes leads to changes in the social relations of journalists and also changes the nature of the interaction between media and audience, contributing to the growth of news and content personalisation. In addition, M. Zdravković & H. Panetto (2022), M. Kareem & D. Ben Aissia (2024) point out that technological changes that enable the automation of content creation processes in media can increase the efficiency of management systems. However, they also emphasise the importance of considering the social aspects of access to such technologies to avoid inequalities in access to information and manipulation. These issues are also highlighted in this study, which focuses on the significance of the social and ethical aspects of integrating AI into media. It emphasises that the distribution of technologies is not always equal, which can create new forms of digital inequality in the media.

C. Van Slyke *et al.* (2023), A. Mahmudi & I. Ramadhani (2024) highlight that AI technologies can not only change the technical aspects of journalism but also social processes, particularly changes in communication processes between journalists and their audiences. They also emphasise the potential of AI in creating personalised news and information flows, enabling a shift in the format of interaction with readers. This is reflected in the research, which also notes that the implementation of AI can significantly change the role of a journalist, transforming them from a traditional content generator into a manager of automated processes that create news and information flows. R. Gangwar *et al.* (2024) noted that AI has great potential for developing media, as it can improve the quality of news through automated content

generation, which also changes social interactions. This is supported by the results, which show that automating content creation through AI not only improves efficiency in media but also reduces the time it takes to prepare news, allowing media companies to respond more quickly to audience needs. At the same time, automation also creates new forms of interaction between journalists and content consumers. D. Safaei *et al.* (2024) emphasise the importance of a sociotechnical approach to adapting AI to media. They highlight the need to consider social aspects when implementing new technologies to avoid negative societal consequences, such as reduced access to truthful and objective information. This study also underscores the importance of social factors, as it was found that the introduction of technologies without proper attention to social conditions can lead to new forms of manipulation and unequal access to information, which negatively impacts both society and journalism.

The results of the study confirm that social aspects must be considered when integrating AI into journalism, as these technologies can significantly change both technical and social processes in the media sphere. The automation of content, the use of chatbots to interact with audiences or algorithms for personalising news can improve access to information, but there are risks associated with changing social connections and relationships between media and their audiences. In particular, there is a need to balance process automation with ensuring appropriate levels of journalistic ethics and fact-checking. It is important that the development and implementation of AI in journalism not only improve access to diverse content but also preserve social connections, as technology can influence how consumers perceive news and how journalists interact with the public. I. Sarker (2022), B. Dhiman (2023) assesses whether artificial intelligence is beneficial to journalists by comparing the advantages and disadvantages of this technology. In their research, they analyse whether AI can be an effective tool that supports journalistic activities or, conversely, poses threats to the profession. Author notes that while automating news creation processes can significantly improve the efficiency of journalists' work, it also calls into question the preservation of journalistic autonomy and professional ethics, particularly in the context of potential content manipulation and technical errors in automatically generated materials. Compared to this study, where the role of AI in journalism was also analysed, it was found that while technology provides new opportunities to improve journalistic efficiency, there are also significant ethical challenges associated with its use, in addition to its potential benefits, confirming the ongoing discussion about the autonomy and independence of journalists when working with AI.

E. Seyfodin & S.J.R. Tabrizi (2024) explore the impact of artificial intelligence on the future of journalism, focusing on how technological advancements can reshape not only the methods of journalists but also the entire

media landscape. They evaluate the new opportunities that arise as well as the challenges associated with integrating AI into journalistic practices. The authors emphasise that AI can be a powerful tool for automating content creation but also highlight the significant changes it brings to professional roles, ethics, and social interactions within media. Their findings align with current research, which also indicates that technological advancements in journalism open up new possibilities for interactive work with audiences but simultaneously require attention to ensuring ethics and the proper use of these technologies to avoid manipulation and bias in information flows. Considering potential challenges, such as the risks of information manipulation or reinforcing "filter bubbles", it is crucial to take steps to preserve social structures and promote pluralism in the media. AI technologies should be implemented in a way that not only automates processes but also upholds journalistic values such as objectivity, ethics, and transparency.

Conclusions

The research established that the application of artificial intelligence (AI) in journalism has a significant impact on the creation of media content, fact-checking, and the ethical aspects of journalistic practice. The study covered the period from 2010 to 2024 and aimed to identify key trends in its use. The findings confirm that AI is actively employed for creating news, articles, videos, and fact-checking, particularly through tools such as ChatGPT, Logically, and Factmata. Through a sociological survey conducted with 200 respondents, important quantitative data was gathered regarding the perception of AI-generated content. The majority of respondents (55%) actively engage with such content, indicating its accessibility and popularity. However, only 23% of respondents fully trust this content, while 57% express caution, emphasising the importance of the human element in journalism. The respondents most frequently cited the speed of content creation and its objectivity as advantages of AI, while the main drawbacks were the lack of depth in analysis and the potential for errors.

During the content analysis, examples of AI use for text creation and fact-checking were examined. It was established that AI algorithms can quickly generate news, allowing media companies to react promptly to events. However, the analysis showed that automated systems often cannot provide a sufficient level of depth in analysing complex topics that require a human approach and interpretation. This is confirmed by the fact that many respondents noted the shortcomings of AI content precisely due to the lack of in-depth analysis. A comparison of automated and traditional content creation methods revealed several differences. While automation can significantly reduce the time it takes to create news, it cannot fully replace the role of journalists in creating complex, analytical materials. At the same time, AI support for fact-checking and combating fake news

received a high rating among respondents, indicating a need to integrate such technologies into journalistic practices. The research also confirmed the importance of the ethical aspects of using AI in journalism. A majority of respondents (58%) expressed concern about the potential job losses for journalists due to automation, emphasising the need to develop ethical standards for AI usage in this field. However, 42% of respondents positively evaluated the use of AI for performing routine tasks, such as fact-checking or creating short news items.

Based on the findings, it is recommended that media companies actively utilise AI to automate routine tasks such as fact-checking and creating simple news

items. However, to ensure high-quality content, human oversight should be maintained for complex and analytical tasks that require a deeper understanding of the context. Future research should focus on developing ethical guidelines for using AI in journalism and finding optimal models for collaboration between humans and automated systems.

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■ Conflict of Interest

None.

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Соціально-комунікаційні аспекти використання штучного інтелекту в інформаційних системах

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Анотація. Метою було дослідити використання штучного інтелекту в медіа та дослідити етичну складову. Методологія включала теоретичний аналіз, вивчення медіа, експертне оцінювання, контент-аналіз, соціологічне опитування та компаративний аналіз. Дослідження присвячене вивченню впливу штучного інтелекту на журналістику, зокрема на створення медійного контенту, перевірку фактів та етичні аспекти використання новітніх технологій у журналістській практиці. В роботі були проаналізовані різні аспекти застосування ШІ у медіа, зокрема використання таких інструментів, як ChatGPT, Logically і Factmata для створення текстів та боротьби з фейковими новинами. Одним із основних результатів дослідження стало визначення частоти споживання контенту, створеного ШІ, та оцінка рівня довіри до такого контенту з боку аудиторії. Аналіз переваг і недоліків ШІ показав, що основною перевагою є швидкість створення контенту, тоді як головними недоліками є відсутність глибини аналізу та ймовірність помилок. В результаті соціологічного опитування та контент-аналізу було підтверджено, що використання ШІ може значно підвищити ефективність рутинних завдань, таких як перевірка фактів, але не може повністю замінити традиційну журналістику, зокрема в складних аналітичних матеріалах. Респонденти позитивно оцінили використання ШІ для перевірки фактів, але висловили занепокоєння щодо потенційного скорочення робочих місць для журналістів. Практична цінність соціально-комунікаційних аспектів використання штучного інтелекту (ШІ) в журналістиці та медіа є важливою в інформаційному середовищі, а саме інтеграція ШІ сприяє створенню, поширенню та аналізу медіаконтенту, а також адаптації медіа до потреб аудиторії.

Ключові слова: медіакомпанії; соціальна взаємодія; доступ до ресурсів; алгоритми; динаміка



Adapting the publishing industry to the digital revolution: Strategies for online publishing and content distribution

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Abstract. The study aimed to identify key aspects of promoting Ukrainian authors and publications on global platforms. The methodology involved a comparative analysis of digital platforms, case studies of Ukrainian and international publishers from countries such as the USA, Germany, Poland, and China, respondent surveys, statistical analysis of sales data, and a SWOT analysis. Research on adapting publishing to the digital revolution has shown that Ukrainian consumers are increasingly favouring electronic book formats, particularly audiobooks. The collected data indicate a growing preference for audio content due to its convenience and accessibility for various user groups. The analysis identified the main trends in the digital transformation of the publishing sector. Leading international platforms such as Amazon Kindle, Google Books, and Apple Books have demonstrated a high level of functionality, particularly due to their user-friendly interfaces, advanced monetisation opportunities, and integration with wide reader audiences. At the same time, it was found that Ukrainian publishing houses such as Nash Format, Yakaboo, and Vivat are actively implementing digital strategies but face certain challenges related to insufficient technical infrastructure and limited access to global markets. An analysis of these companies' experiences identified key factors for successful digitalisation, including the importance of adapting to consumer needs, expanding opportunities for self-publishing, and enhancing interactive engagement with audiences. Based on a survey of 200 respondents, trends in audiobook consumption, popular platforms, thematic preferences, and behavioural patterns across different age groups were identified. The findings indicate that demand for audiobooks in Ukraine has significant growth potential, particularly among younger audiences willing to pay for subscriptions to digital platforms. An analysis of platform functionality and publishing industry practices highlighted key areas for improving digital services: localisation, the development of marketing tools, and the optimisation of user interaction

Keywords: emerging technologies; information platforms; content distribution; innovation; media business

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Introduction

The adaptation of the publishing industry to the digital revolution is a pivotal process transforming the methods of content production, distribution, and consumption. These changes encompass not only technological aspects but also strategic, organisational, and economic ones. The development of digital technologies creates new opportunities for online publishing, where platforms and content distribution tools allow for rapid reach of global audiences. Technological advancements significantly reduce the costs of production and distribution, which previously required substantial resources. However, this process is accompanied by challenges, including the need for publishers to adapt to new business models, changes in legal regulation, copyright protection, and ensuring content quality. Additionally, questions arise regarding the effectiveness of using digital platforms to provide access to knowledge and cultural products.

Online publishing strategies require adaptation to rapidly changing consumer preferences, expanding opportunities for interactive content formats, and developing new distribution models. At the same time, significant attention should be paid to content monetisation, as new technologies and business models create additional risks and opportunities for the financial stability of publishers. A significant number of researchers have studied this topic, presenting various perspectives. For instance, H.A. Albadri (2023) explored the integration of traditional media into the digital environment, highlighting the gap between the capabilities of digital technologies and the level of their implementation. The author's conclusions emphasised the importance of strategic planning for publishing houses to successfully adapt to change. G. Appel *et al.* (2020) examined the impact of social media on marketing, particularly in the context of content promotion and audience engagement. The authors noted that publishing houses used social platforms to interact with readers, expand markets, and increase sales, demonstrating their effectiveness in the digital age. In their research, W.W. Baber *et al.* (2019) analysed the transition of publishing companies to digital platforms and the evolution of their business models. They found that adapting to digital distribution improved access to global markets and allowed publishers to experiment with new forms of content monetisation. R. Birner *et al.* (2021) investigated the digital revolution across various sectors, including publishing. Their research highlighted the role of pioneering players who introduced digital technologies, such as platforms for distributing ebooks and audiobooks. D. Casciani *et al.* (2022) examined the nature of digital transformation in different industries, emphasising innovations in business models and supply chains. The authors highlighted the need for implementing innovations in business models and supply chains, particularly through digital transformation, which is crucial for publishers to adapt to modern market conditions and maintain

competitiveness. M. Cosa (2024) explored the adaptation of business strategies during digital transformation. The author concluded that publishing houses that invested in developing online platforms ensured their sustainability and competitiveness in the market.

In their research, W. Liu (2023) examined strategies for developing electronic publishing in small markets, particularly the role of content localisation and the use of innovative formats such as audiobooks. They emphasised the importance of collaboration with local authors and platforms to achieve success. A.M. GomezTrujillo & M.A. Gonzalez-Perez (2022) investigated how digital transformation contributed to achieving sustainable development. The conclusions of these authors are significant for publishing houses that have integrated environmental strategies into their business models. A. Hanelt *et al.* (2020) conducted a systematic literature review of digital transformation, particularly in the publishing industry. They noted that success depended on companies' ability to adapt their organisational structures to digital challenges. M.A. Hashim *et al.* (2022) analysed digital transformation strategies in education, which partially overlapped with the publishing industry. The authors argued that innovations in platform environments contributed to engaging larger audiences. Yu. Palekha & V. Sadovenko (2022), Y.A. Ishchuk & M.L. Varlamova (2023) explored the digitalisation of publishing as part of global creative industries. They stated that the use of e-books and audiobooks contributed to increasing publishing house profits and attracting a younger audience.

Despite significant progress in researching the digital adaptation of the publishing industry, there remain several gaps that require further analysis. Authors have predominantly focused on global aspects, such as leading international platforms, but the impact of local context, including cultural and economic particularities, remains under-researched. Additionally, there is a lack of comprehensive analysis of the environmental consequences of digital transformation and its impact on the industry's sustainable development. Insufficient attention has been paid to a deep understanding of consumer behaviour, particularly differences in the use of digital formats among various demographic groups. The issue of copyright protection and combating piracy has been superficially explored, without a detailed analysis of the effectiveness of existing solutions. Thus, there is a need to focus on consumer behavioural characteristics and mechanisms for protecting intellectual property to further refine approaches in the field.

The aim of this study was to examine the specific features of the process of adapting Ukrainian publishing houses to digital formats.

Materials and Methods

The research employed a variety of materials to achieve the goals of analysing the digital transformation of the

publishing industry. Specifically, statistical data from companies such as Nash Format (2022), Yakaboo (2022), and Vivat (2023) and the Booknet platform were utilised. These case studies enabled the assessment of the dynamics of e-book and audiobook sales, particularly across age groups and sales channels such as Google Play and Amazon. Additionally, practical case studies of international publishing houses were examined, including HarperCollins Publisher (2025) in the USA, Bertelsmann Company (2025) in Germany, Virtualo (2025) in Poland, and China Publishing Group (2025) in China. Their strategies served as a benchmark for comparing digital transformation methods in different market conditions. A comparative analysis was conducted of documents regulating copyright protection and the fight against piracy in Ukraine, the USA, Poland, and Germany. This included the Digital Millennium Copyright Act (DMCA) (1998) in the USA, the Law of Ukraine No. 2811-IX (2022), the Law of Ukraine No. 1234-VII (2010), EU legislation on copyright in the digital age, applicable to Germany (Directive (EU) 2019/790, 2019), and the Berne Convention for the Protection of Literary and Artistic Works (World Intellectual Property Organization, 1971). These documents were examined to analyse approaches to copyright protection in the digital environment and the effectiveness of anti-piracy measures in different jurisdictions.

A comparative analysis was conducted of leading digital platforms, such as Amazon Kindle, Google Books, and Apple Books, based on criteria such as content monetisation, user experience, content distribution, support for various devices (smartphones, tablets, computers, e-readers), author and publisher features, availability of marketing tools, support for localisation and translation, and reader interaction features. A survey was conducted among 200 participants who volunteered through social media and online survey platforms. Participants were divided into two age groups: 100 aged 25-30 and 100 aged 31-35. Of the respondents, 120 were women and 80 were men. All participants resided in Ukraine, specifically in Kyiv, Lviv, Odesa, and Kharkiv. The survey consisted of eight questions aimed at understanding respondents' preferences for digital book formats, particularly audiobooks:

1. Which format of books do you usually read (paper, e-book, audiobook)?
2. How much of your time do you spend listening to audiobooks?
3. What genre of audiobooks interests you the most?
4. How often do you purchase or rent audiobooks through online platforms?
5. Which platforms do you use for listening to audiobooks?
6. What was your average age when you first started listening to audiobooks?
7. How do you rate the convenience of using audiobooks compared to other formats?
8. Are you willing to pay for a subscription to audiobooks or platforms for listening to content?

Responses were evaluated using quantitative methods. Participants were able to select one or more options for each question. The results were analysed using statistical methods to determine the frequency of responses and identify key trends in respondent preferences. The study was conducted following the principles of ASA's Committee on Professional Ethics (COPE) (1997).

A comparative analysis was conducted to examine the features and strategies of leading digital platforms such as Amazon Kindle, Google Books, and Apple Books, enabling the identification of their strengths and weaknesses. Case studies were employed to investigate the successful digital transformation of Ukrainian publishing houses like Nash Format, Folio, Yakaboo, and Vivat. Similarly, case studies of international publishers, including HarperCollins, Bertelsmann, Virtualo, and China Publishing Group, were analysed to compare their strategies with those of Ukrainian counterparts. Statistical analysis of e-book and audiobook sales data was used to study changes in demand for these formats across different age groups. A SWOT analysis was conducted to assess the strengths, weaknesses, opportunities, and threats associated with the digital adaptation of Ukrainian publishing houses.

Results

Analysis of case studies of Ukrainian publishing houses in digital transformation: An environmental and legal perspective. The digital revolution has significantly transformed the publishing industry, altering traditional approaches to content creation, distribution, and consumption. There is a growing emphasis on e-books, audiobooks, interactive publications, and digital distribution platforms. These changes not only present new opportunities but also pose challenges for market participants. The digital transformation of publishing in Ukraine is occurring amidst global trends, as printed books are gradually being replaced by electronic and audio formats. In this context, Ukrainian publishing houses play a significant role as they strive to adapt to market changes. One of the most successful examples of digital transformation is the Yakaboo platform, which has become a leading online bookstore in Ukraine. In addition to printed publications, Yakaboo actively promotes e-books and audiobooks, collaborating with popular publishers and authors. The platform boasts a substantial user base and its digital library is continually updated, offering convenient access to a wide range of literature in various formats. Another example is the publishing house Nash Format, which reported a 1.7-fold increase in revenue from e-books and audiobooks in 2023 (Forbes Ukraine, 2024). This demonstrates how Ukrainian publishing houses are adapting to new market demands and responding to consumer needs. However, Ukrainian publishing houses face challenges in successfully implementing digital transformation. One barrier is the insufficient technical preparedness of some

publishers for effective e-book distribution. Many of these publishers still rely on traditional distribution models, focusing on print books, which limits their capabilities in the digital market. This is often due to a lack of investment support for building technical infrastructure and integrating new technologies.

The legal framework governing digital transformation in the Ukrainian publishing industry is another crucial aspect. The enactment of the Law of Ukraine No. 2811-IX (2022) marked a significant milestone in regulating this sector. This law provides a legal foundation for electronic transactions, including the sale of e-books and other digital goods. It governs the formation of electronic contracts, consumer protection, and the interaction between sellers and buyers in the digital environment. Copyright laws also play a pivotal role for publishing houses as they define the conditions for protecting intellectual property in the digital realm. The Law of Ukraine No. 2811-IX (2022) ensures that authors' rights to electronic copies of their works are respected. Additionally, the Law of Ukraine on the Protection of Personal Data (2024) is a crucial component of the legal framework, regulating the collection and use of personal information of users who register on ebook platforms. This is necessary to ensure the security and confidentiality of data provided by users during online purchases.

Additionally, the Law of Ukraine No. 2811-IX (2022) serves as the cornerstone for protecting authors' rights and combating copyright infringement. This law grants creators control over their works, including the rights of reproduction, distribution, and public performance. It establishes licensing mechanisms and enforcement procedures, detailing the legal processes for addressing infringements such as unauthorised use or piracy. The law is also aligned with international copyright conventions, facilitating the protection of Ukrainian creators' rights on a global scale. However, the effectiveness of this regulatory framework remains a pressing issue due to ongoing problems with piracy and limited resources for monitoring digital platforms, indicating a need for strengthened control and protection mechanisms. Complementing these laws, Ukraine also has various programs and initiatives aimed at fostering the development of digital technologies. One such measure is government grants for small and medium-sized enterprises in the digital technology sector, which can be utilised by publishing houses to create digital platforms and content. The digital transformation of Ukrainian publishing houses is a complex process. Successful examples, such as Yakaboo and Nash Format, demonstrate the potential and opportunities for digital adaptation, but several challenges remain, including insufficient technical preparedness and regulatory limitations. Legal challenges may include difficulties with copyright and content licensing on international platforms, limiting the possibilities for book sales and distribution. Additionally, regulations governing digital formats and intellectual

property protection vary across countries, creating further barriers for publishers.

The introduction of amendments, particularly to the Law of Ukraine No. 2811-IX (2022), defining terms such as "digital content" and "digital services", establishing legal frameworks for their provision, protecting consumer rights, strengthening personal data protection, and regulating supplier obligations and electronic contracts, should contribute to the further development of this sector. These legal changes create a solid foundation for effective operation in the digital market and ensure the protection of authors' and publishers' rights. In this context, international agreements and conventions, such as the Berne Convention for the Protection of Literary and Artistic Works (World Intellectual Property Organization, 1971), play a crucial role in providing a legal framework for the protection of authors' and publishers' rights in various countries, including Ukraine. However, in the context of globalisation and the complexity of internet platforms, copyright infringements have taken on a global character, necessitating increased international cooperation to prevent and combat piracy. New technologies, such as blockchain, are being employed to protect copyright. Blockchain enables the storage of information about authorship and content transactions in an immutable ledger, allowing for continuous tracking of the use of digital products. This could become an effective way to combat copyright infringement in the future. For Ukrainian publishing houses to successfully adapt to digital formats, it is essential to consider the specifics of local markets, including understanding the behaviour of Ukrainian consumers and effectively protecting intellectual property. These factors will contribute to the development of sustainable strategies that will allow publishing houses and authors to maintain their income and support the growth of Ukraine's digital economy, a crucial aspect of adapting to the modern global market.

Ukraine is experiencing a surge in digital publishing. According to Yakaboo, the market for e-books and audiobooks in Ukraine grew by 20% in 2023 compared to the previous year (Forbes, 2024). Approximately 15% of Ukrainian readers prefer ebooks, aligning with global trends (RBC Ukraine, 2020). The utilisation of platforms for digital content distribution has significant environmental implications. The shift to digital formats offers a substantial reduction in the environmental impact compared to traditional print books, which require paper, energy, and transportation. E-books, on the other hand, eliminate the need for physical resources, reducing deforestation and carbon emissions associated with transportation. This allows publishing houses to significantly decrease their carbon footprint, positively impacting the environment. However, while the production of e-books does not have direct environmental costs, the digitalisation process itself is not entirely waste-free.

A significant aspect of digital transformation is the substantial energy consumption associated with

processing and storing digital data. Servers supporting online platforms for selling e-books and audiobooks, as well as data centres required for content storage, consume vast amounts of electricity. Considering that a significant portion of this energy is still generated from non-renewable sources, digitalisation can contribute to increased greenhouse gas emissions. This highlights the need for improvements in energy infrastructure to ensure sustainable development. Publishing houses seeking to minimise their environmental impact can focus on cloud services and data centres that utilise renewable energy sources. Digital transformation also impacts sustainable development by enabling publishers to conserve resources and reduce costs by minimising physical expenditures on paper, transportation, and logistics. However, it is important to note that this transition is not without challenges for Ukrainian publishing houses. Publishing houses actively integrating digital platforms are facing new environmental challenges, such as the need for energy-efficient technologies and the search for more sustainable methods of content storage and delivery. A crucial aspect of sustainable development is its social component, and reducing energy consumption through ecoinitiatives in the publishing industry helps to ensure greater environmental responsibility in business. While the digitalisation of publishing can reduce the negative environmental impact compared to traditional book production methods, it is important to remember the environmental consequences associated with energy consumption and technology use. As publishing houses continue their digital transformation, they should focus on the energy efficiency of their operations and work to optimise their energy consumption to ensure sustainable development and minimise their environmental impact.

International experience of digital adaptation of publishing houses compared to Ukraine. The global digital publishing market is experiencing significant growth. According to Statista (2024), the worldwide

e-book market was valued at over 15 billion USD in 2024, with an average annual growth rate of 4-5%. This indicates a steady expansion of the industry, driven by new technologies and digital content distribution platforms. The popularity of digital formats varies across countries. E-books account for approximately 25-30% of the book market in developed countries, where they have become a staple for readers who value convenience, accessibility, and the ability to store vast libraries on a single device. However, audiobooks are the fastest-growing segment, demonstrating growth of over 20% annually. Demand for this format is increasing as more people listen to books while commuting or exercising, adding convenience to traditional reading. Countries leading in digital publishing have adopted diverse approaches to developing this market. In the USA, over 50% of e-book sales are conducted through the Amazon Kindle platform, solidifying its position as the undisputed market leader. In Germany, Tolino is a strong competitor to Kindle and is popular among European readers. China, on the other hand, has a developed ecosystem of local platforms such as WeRead and DangDang, where over 60% of young people prefer e-books, indicating a high level of digital literacy and the popularity of such formats among Chinese users (Meyer *et al.*, 2023). Amazon Kindle remains one of the primary platforms for Ukrainian authors seeking to reach the international market, providing access to a global audience (Amazon Kindle, 2023). This development in digital publishing is actively creating new opportunities for authors and publishers, opening up access to international markets. Such a shift to digital platforms and the integration of new formats is a crucial part of the strategy of Ukrainian publishers adapting to the changes occurring in the global industry. Table 1 presents a comparison of practical approaches and strategies used for the transition to digital platforms, which is essential for understanding current trends and the prospects for the development of publishing in the digital revolution.

Table 1. Comparison of case studies of digital adaptation of publishing houses in Ukraine and other countries

Country	Case studies	Features
Ukraine	Thanks to collaboration with platforms such as Amazon Kindle and Audible, Nash Format was able to increase e-book and audiobook sales, which accounted for 30% of total sales in 2022	This phenomenon is driven by the convenience of accessing books through various devices, allowing readers and listeners to store, organise, and quickly access books without the need to physically visit a bookstore. Focus on non-fiction literature, collaboration with Amazon Kindle and Audible
	A doubling of demand for audiobooks among young people (25-35 years old) in 2022 on Yakaboo was made possible by the active development of digital platforms and the popularisation of the audio format among this age group	Local platform for e-books and audiobooks, actively integrating into the digital market
	The successful sale of books through Google Play and Amazon at Vivat was made possible by an effective distribution strategy, which allowed the company to reach a wide audience and provide access to content on popular international platforms	Active collaboration with international platforms to expand the audience
USA	HarperCollins: Use of its own platform for e-book sales and collaboration with Audible for audiobooks	Creation of an ecosystem that allows for maximum control over publishing, sales, and distribution processes

Continued Table 1.

Country	Case studies	Features
Germany	Bertelsmann: The platform brought together local publishers to compete with Amazon	Localised platform supporting independent publishers, helping them avoid reliance on major players
Poland	Virtualo: Focus on digital books, collaboration with local authors	Active engagement with the local market, particularly through supporting authors and localising content
China	China Publishing Group: Monetisation of content through subscriptions, allowing authors to earn higher incomes	A powerful ecosystem with a high level of audience engagement, aimed at the mass market and supporting authors through innovative monetisation models

Source: created by the authors based on data from Nash Format (2022), Yakaboo (2022), Vivat (2023), HarperCollins Publisher (2025), Bertelsmann Company (2025), China Publishing Group (2025)

A comparative analysis of digital adaptation strategies among Ukrainian and international publishing houses reveals both commonalities and distinctive approaches. Ukrainian publishers have been leveraging international platforms to expand their reach. For instance, Nash Format (2022) has significantly increased its sales, particularly in non-fiction, through partnerships with Amazon Kindle and Audible. Meanwhile, Yakaboo has observed a surge in audiobook demand among young adults, demonstrating the success of its localised platform. Vivat has also successfully distributed its books through global platforms like Google Play and Amazon. In the USA, HarperCollins Publisher (2025) has prioritised building its own ecosystem for e-book sales and partnering with Audible for audiobooks, enabling greater control over the publishing and distribution process. In Germany, Bertelsmann Company (2025) has united local publishers to compete with Amazon, creating a national platform to support independent publishers. Poland's Virtualo has focused on digital books and collaborated with local authors, offering solutions tailored to the domestic market. China offers a unique approach with platforms like WeRead, which employ a subscription-based monetisation model, enabling authors to earn higher royalties (China Publishing Group, 2025). The Chinese experience also showcases the effectiveness of integrating platforms into users' daily lives, demonstrated by high levels of audience engagement. Self-publishing platforms like Amazon Kindle Direct Publishing (KDP) and Apple Books have empowered authors globally. By self-publishing, authors retain a larger share of royalties, can quickly respond to market demands, and receive direct feedback from readers worldwide. Selfpublishing allows authors to control the entire publication and promotion process, fostering personal branding on a global scale. To succeed in international markets, Ukrainian authors must adapt their works to the cultural and linguistic nuances of different countries. Translations into foreign languages are crucial. Employing professional translators who can preserve the cultural essence of the work while ensuring linguistic accuracy is essential for producing high-quality content for international audiences. Cultural adaptation also involves adjusting the context to align with the interests and perceptions of specific target audiences. This can increase demand for Ukrainian books in

markets such as Europe, the USA, and Asia, where there is growing interest in new cultures and literature.

Targeted advertising and active use of social media are powerful tools for promoting Ukrainian publications on global platforms. Facebook Ads, Google Ads, Instagram, and Twitter enable precise targeting of potential readers worldwide, considering their interests, demographics, and behavioural factors. This allows authors and publishers to spend their advertising budget efficiently, reducing the cost of misdirected ads. Additionally, active engagement with readers on social media platforms fosters online communities around books, increasing audience loyalty and stimulating sales. Sharing reviews, announcements, video reviews, and author interviews all contribute to promoting works and strengthening author branding. International literary events such as book fairs (like the Frankfurt Book Fair), festivals, and awards are crucial for popularising Ukrainian authors on a global scale. Participation in such events provides opportunities to showcase works to an international audience, establish contacts with foreign publishers and agents, and connect with other authors. Literary awards like the Booker Prize or the Goncourt Prize can be significant milestones in achieving international recognition, helping to draw attention to Ukrainian writers. Recognition at such prestigious competitions boosts sales and creates opportunities for further publications abroad. In conclusion, a combination of these strategies enables Ukrainian authors and publishers to successfully promote their works on international markets, expanding their readership and unlocking new growth opportunities. Not only does this contribute to economic success but also facilitates cultural exchange, introducing Ukrainian literature to a global audience.

Digital formats for books and audiobooks have become integral to the modern publishing industry, offering new avenues for content distribution and transforming how readers engage with literature. The shift to digital formats allows publishers to significantly reduce printing and storage costs while increasing content accessibility for a wider audience. Moreover, digital platforms empower users to access books anytime, anywhere, expanding the market and enhancing user convenience. Thanks to technological advancements, digital book formats, such as e-books and audiobooks, have become increasingly popular. Their convenience and the ability to

personalise content to user preferences have driven this growth. Therefore, understanding consumer preferences and attitudes towards digital formats is crucial for comprehending the evolving trends in the publishing industry. To gain a better understanding of the preferences of participants, a survey was conducted among residents of

Kyiv, Lviv, Odesa, and Kharkiv. Participants were selected based on voluntary participation through social media and online survey platforms. The survey included a diverse group of people, which provided a more varied picture of attitudes towards digital book formats and audiobooks. The results of the survey are presented in Table 2.

Table 2. Survey results on participants' preferences for digital book and audiobook formats

Question	Primary Responses
1. What format of books do you usually read (paper, electronic, audiobook)?	Paper – 45%, Electronic – 35%, Audiobook – 20%
2. How much time do you spend listening to audiobooks?	Less than 1 hour per week – 50%, 1-3 hours – 35%, More than 3 hours – 15%
3. What genre of audiobooks are you most interested in?	Fiction – 40%, Self-development and motivation – 30%, Popular science – 20%, Other – 10%
4. How often do you buy or rent audiobooks through online platforms?	Rarely (1-2 times per year) – 60%, Occasionally (once every few months) – 30%, Regularly (monthly) – 10%
5. What platforms do you use for listening to audiobooks?	Storytel – 40%, Audible – 25%, Google Books – 15%, Other – 20%
6. What was your average age when you started listening to audiobooks?	Under 25 years – 50%, 25-30 years – 35%, Over 30 years – 15%
7. How do you rate the convenience of using audiobooks compared to other formats?	Convenient – 70%, Neutral – 20%, Inconvenient – 10%
8. Are you willing to pay for a subscription to audiobooks or content listening platforms?	Yes – 55%, No – 45%

Source: created by the authors

Table 2 presents the results of a survey conducted to investigate participants' preferences for digital book and audiobook formats. The majority of respondents expressed a preference for physical books, although e-books and audiobooks also have a significant following. Analysis of time spent listening to audiobooks revealed that half of the respondents listen for less than an hour per week, while a substantial proportion spend 1-3 hours. Regarding audiobook genres, fiction, self-development, and motivation were the most popular choices. According to the survey results, respondents infrequently purchase or rent audiobooks, doing so only a few times a year. Storytel and Audible were identified as the most popular platforms for listening to audiobooks. Most respondents began listening to audiobooks before the age of 25, and the majority rated the experience as convenient. At the end of the survey, it was found that most participants were willing to pay for a subscription to audiobooks or content listening platforms.

Advantages and disadvantages of digital transformation for Ukrainian publishers and entering global markets. The success of Ukrainian publishing houses in the digital market is evident in numerous case studies showcasing their strategies for adapting to new

conditions and expanding into the international market. For example, Old Lion Publishing House has emerged as a leading player in the Ukrainian market, actively implementing digital technologies. Their strategy involves expanding their reach beyond Ukraine by releasing e-books and audiobooks, attracting a new audience that prefers digital formats (Oklander *et al.*, 2024). The publisher has also focused on localising content into English and other languages to reach international platforms like Amazon Kindle and Apple Books. Additionally, collaborations with audiobook platforms such as Audible have expanded their audience beyond Ukraine. Nash Format is a publishing house focused on the non-fiction genre, particularly scientific literature, biographies, business books, and psychology. They actively use selfpublishing platforms, such as Amazon Kindle and Audible, where their books have seen strong demand among international readers. The publishing house has several bestsellers in its portfolio, including "The Subtle Art of Not Giving a F*ck" by Mark Manson, "Atomic Habits" by James Clear, becoming by Michelle Obama, and "Where the Crawdads Sing" by Delia Owens, all of which gained popularity through promotion on these platforms. One of the key steps was forming strategic partnerships with foreign publishers, enabling

them to publish books abroad and use international channels for distribution.

Yakaboo, one of the largest Ukrainian online platforms for e-books and audiobooks, has also successfully expanded into international markets. They created a local platform for selling and promoting books, which became a primary tool for Ukrainian authors looking to enter digital markets. However, the most significant achievement for Yakaboo is its successful expansion beyond Ukraine. They began selling Ukrainian books through international platforms such as Google Books, Amazon Kindle, and Apple Books, helping to popularise Ukrainian literature abroad. Yakaboo also actively collaborates with both Ukrainian and international publishers, particularly in the audiobook sector, and continues to expand its offerings. Joint initiatives between publishers and Ukrainian startups to develop mobile reading apps are an important part of the digital market's development in Ukraine. Publishing houses are increasingly collaborating with technology companies to develop their own mobile applications, providing convenient access to e-books and audiobooks. Ukrainian companies such as Bookmate, Librarius, GUTENBERGZ, Yakaboo, and Kniga.biz.ua specialise in developing reading apps and work closely with publishers to integrate their content onto mobile platforms. This enables

readers to access e-books and audiobooks directly from their mobile devices, making reading more convenient, especially for those who frequently travel or have limited access to traditional bookstores. Such collaborations contribute to the growing popularity of digital publications and support the development of digital infrastructure in Ukraine. These case studies demonstrate how Ukrainian publishers are adapting to the digital age, utilising modern platforms and technologies to achieve global success. The strategic use of online platforms, content adaptation for international markets, and collaborations with tech startups are creating new opportunities to promote Ukrainian literature globally. Digital transformation has significantly altered the distribution and consumption of literature, offering new avenues for publishers. A crucial aspect of this process is the development of mobile reading apps, which enable seamless integration of content into mobile platforms. This not only enhances accessibility to books and audiobooks but also transforms the way readers interact with literature. This shift demands a comprehensive approach to digital adaptation strategies for publishing houses, encompassing not only the adoption of new technologies but also strategic business model planning. The results of this process can be evaluated through a SWOT analysis, as illustrated in Table 3.

Table 3. SWOT analysis of the publishing house's digital adaptation

Strengths	Weaknesses
Digital platforms allow authors and publishers to reach readers worldwide without intermediaries	It is difficult to highlight quality works among the vast number of new publications on digital platforms
No costs for printing, delivery, and physical storage, making book publishing cheaper and more accessible	Technical failures or changes in platform algorithms can impact book visibility and sales
The ability to publish books in digital and audio formats, catering to different reader needs	In some countries, there are restrictions on access to payment systems, which complicates entry into international markets, such as Venezuela, Iran, Cuba, Syria, and North Korea
Opportunities	Threats
Localisation of content and translations into foreign languages opens new markets for Ukrainian authors	A huge number of authors and books on global platforms creates challenges in promoting and ensuring the visibility of works
The development of interactive books, multimedia content, and audiobooks allows for experimentation with new formats	Piracy and illegal content copying are significant issues on digital platforms
Collaboration with major platforms (Amazon, Google Books, Apple Books) enables the promotion of Ukrainian literature globally	Algorithms and policies of major platforms (e.g. Amazon) can change, potentially impacting revenue and book visibility
Digital platforms offer numerous promotional opportunities, including targeted advertising	Authors and publishers require specialised educational programmes to effectively use the opportunities offered by digital platforms

Source: created by the authors

In Ukraine, there is also an active process of publishers transitioning to digital formats. A notable example is the Folio publishing house, which has successfully integrated e-book sales through its own website. This approach allows for better control over pricing and sales terms while reducing reliance on international online retailers like Amazon. The publishing house actively collaborates with audiobook platforms such as Storytel, expanding its reach to an audience that prefers listening to books. These partnerships contribute to content monetisation and attract new users who value

the convenience of digital audio formats. Additionally, platforms like Yakaboo have emerged as prominent online bookstores in Ukraine, offering a range of e-books and audiobooks. This platform offers a wide range of books in Ukrainian and other languages, enabling local authors and publishers to distribute their content both domestically and internationally. Simultaneously, collaborating with digital book platforms empowers authors to reach a broader audience and gain greater visibility without relying solely on international giants. In Ukraine, Vivat Publishing House is actively developing digital

formats. They focus on expanding their e-book and audiobook offerings, partnering with platforms like Google Play Books and iBooks. These platforms enable authors and publishers to reach a global audience, providing access to international markets. Vivat actively works with Ukrainian authors, publishing books that reflect the cultural and social realities of Ukraine while simultaneously tapping into the global digital market.

Given the significant potential of Ukrainian platforms, many are focused on empowering authors to retain control over their content. Platforms like Booknet (2025) are actively working to develop the local market and distribute ebooks through partnerships and interfaces, balancing global trends with local market needs. This underscores the importance of independent platforms in supporting Ukrainian authors and publishers within the context of globalisation. Ukraine is experiencing positive dynamics in the development of digital formats, enabling local publishers to effectively collaborate with domestic platforms and access global markets. This approach strengthens the position of Ukrainian authors and publishers in the digital marketplace and reduces reliance on international corporations.

Ukrainian publishers are actively adapting to digital formats, demonstrating positive results in the development of the e-book and audiobook markets. Thus, Ukrainian publishers are focused on integration with global platforms to expand their audience, while international experience shows various approaches, from creating their own ecosystems and local platforms to innovative monetisation models. Ukrainian publishers should consider this experience to develop the national market and expand to the international level.

Recommendations for Ukrainian publishing houses adapting to digital formats. Ukrainian publishing houses should actively embrace new technologies to adapt to the digital landscape. A crucial first step is to create their own online platforms for selling e-books, enabling them to control pricing, sales terms, and retain a larger share of revenue. International examples, such as Penguin Random House, which utilises its own platforms for complete control over publication and distribution processes, can serve as a benchmark. Additionally, collaborating with international platforms like Amazon Kindle, Google Books, and Apple Books, as well as popular Ukrainian platforms like Yakaboo, can attract a wider international and local readership, increasing sales.

Investing in the development of audiobooks is another important area. The demand for audiobooks in Ukraine, especially among younger demographics, is growing rapidly. Collaborating with platforms like Audible can reduce reliance on large international players and allow Ukrainian publishers to carve out a niche in the international audiobook market. By creating additional formats such as podcasts or author interviews, publishers can further expand their audience.

Protecting intellectual property and combating piracy is equally crucial. Publishers must invest in digital content protection tools and develop legal mechanisms to safeguard the rights of authors and publishers. This includes ensuring the security of electronic formats, implementing digital watermarking systems, and creating mechanisms to monitor illegal content distribution. Only in this way can copyright be protected and a stable revenue stream from digital book sales be ensured. It is also essential to engage with government institutions and advocate for legislative initiatives that provide effective protection for intellectual property in the digital environment.

Discussion

Digital transformation has fundamentally reshaped the publishing industry. A key finding of this research is that the transformation has opened up new avenues for content distribution, enabling publishers to expand their reach and reduce costs associated with traditional publishing methods. Publishers have had to adapt their strategies, embracing online platforms, revising business models, and exploring innovative monetisation techniques. These changes have become integral to the digitalisation process and are essential for maintaining competitiveness in the modern market. Specifically, digital transformation has enabled publishers to integrate innovative marketing strategies to reach a broader audience through online platforms. This is also true for the publishing sector, where the shift to digital platforms has helped reduce costs associated with traditional publication and content distribution channels. By significantly reducing the costs associated with printing and distribution, publishers have been able to optimise their expenses and lessen their reliance on physical distribution channels. Research findings corroborate that the utilisation of digital platforms has empowered Ukrainian publishers to expand their reach and attract new audiences, enhancing their market competitiveness. Similarly, F. Pascucci *et al.* (2023) highlighted that digital technologies have become powerful tools that transform consumer behaviour and interactions with brands. Digital platforms not only enable publishers to disseminate content but also facilitate active engagement with their audience, significantly improving communication effectiveness. The research findings demonstrate that Ukrainian publishers have adapted their strategies to leverage digital channels for interacting with readers, acquiring new subscribers, and developing personalised content. The use of social media, websites, and mobile applications allows publishers to respond swiftly to evolving audience needs and adjust content according to their interests.

The research by M. Hresko (2023), D. Plekhanov *et al.* (2023) emphasised the importance of adapting business models to changing market conditions for successful digital transformation. As traditional publishing business models underwent significant changes, many publishers faced challenges when transitioning to new

digital strategies. Specifically, many companies encountered difficulties in implementing effective content monetisation strategies, particularly amid high competition on digital platforms. However, after adjusting strategies and changing their approaches to content monetisation, publishers were able to achieve significant success. The research results confirm that after the implementation of new business models focused on integrating online sales, subscriptions, and advertising, Ukrainian publishers improved their profitability and enhanced the effectiveness of content distribution. Thus, digital transformation became a key driver of change in the publishing industry, allowing publishers to adapt their strategies and ensure increased competitiveness in the global market. An important aspect of this process was the introduction of innovative monetisation models, as well as the active use of digital platforms for publishing and engaging with audiences. The analysis of the research results indicates that, although Ukrainian publishers faced certain challenges, they were able to effectively adapt to new conditions and reap significant benefits from the shift to digital technologies. Digital technologies have had a substantial impact on changes in consumer behaviour and the adaptation of businesses to new conditions.

The study by H. Kryshchal (2024) examines the impact of digital tools on intellectual development. The author analyses how various digital technologies, including online learning platforms and digital media, can contribute to increased knowledge and skills among the population, particularly in the context of rapid social and technological change. This research aligns closely with the current study, which examines the adaptation of publishing houses to digital formats – a crucial aspect of digitalisation in the cultural and educational sectors that impacts the accessibility and quality of information for a wide audience. Similar to the present study, H. Kryshchal (2024) focuses on the potential of digital platforms to enhance access to knowledge and support sustainable development through intellectual growth. These findings are also reflected in the research of A. Sharabati *et al.* (2024), underscores the importance of digital marketing for small and medium-sized enterprises. Digital technologies have become instrumental in improving the efficiency of these companies by reducing costs associated with traditional marketing channels and expanding their reach through access to global digital markets.

Within the publishing industry, this trend has been particularly evident, as Ukrainian publishers have significantly reduced costs associated with traditional distribution channels such as print and physical distribution. By leveraging digital platforms, publishers have been able to enhance their competitiveness, cut costs, and expand their reach to international markets. The research by S. Sindakis & G. Showkat (2024) supports this finding, emphasising the crucial role of digital platforms in maintaining competitiveness in the face of rapid market

changes. They highlight that the transition to digital platforms allows businesses to adapt to evolving market dynamics and remain competitive. This was also confirmed in the context of Ukrainian publishers, who managed to optimise their processes significantly by transitioning to online platforms. By leveraging platforms such as online stores, digital subscriptions, and social media, publishers were able to not only provide access to their publications for a wider audience but also effectively manage their distribution and marketing processes. This digital adaptation has enabled Ukrainian publishers to become more agile and cost-effective, ultimately improving their market position.

F. Yang & S. Gu (2021) and K. Spjeldnæs (2022) explored the changes in literary publishing brought about by platformisation, highlighting how digital platforms are transforming the ways authors, publishers, and readers interact. They emphasised the importance of new models of interaction that foster closer connections between authors and their audiences. This was corroborated in the practices of Ukrainian publishers, who began actively integrating new interaction models through digital platforms. They utilised online platforms to engage with authors, providing convenient mechanisms for publishing and feedback from readers. As a result, publishers were able to lower the barriers for new authors and create platforms for content publication without traditional limitations. This approach allowed them to maintain flexibility in working with new authors and broaden their audience, which is a key aspect of adapting to digital transformation. S. Syamsuddin *et al.* (2024) stated that adapting to the digital revolution enables businesses to enhance their efficiency by using new technologies and optimising workflows. They noted that technological changes allow businesses not only to reduce costs but also to create new opportunities for growth in global markets. By shifting to digital platforms, businesses were able to cut costs related to printing and logistics, while also ensuring quicker access to global markets. The use of cutting-edge technologies, such as e-books and platforms for content distribution, enabled publishers to respond swiftly to market changes and effectively reach new consumers.

In their study, A. Terzi *et al.* (2023) emphasised the importance of using digital technologies to support innovation and competitiveness in European markets. They noted that innovations driven by digital transformations enable companies not only to adapt to new conditions but also to maintain their market leadership. This is particularly relevant for Ukrainian publishers, as they too must not only adapt their strategies to digital technologies but also reassess their business models to maintain competitiveness. Given the significant potential of Ukrainian platforms for development, a key aspect is providing authors with the ability to retain control over their content. Platforms such as Booknet (2025) actively promote e-books among local readers and authors. They facilitate market expansion through partnership

programmes and user-friendly interfaces. This enables Ukrainian platforms to maintain a balance between global innovations in digital publishing and the specific needs of the local audience.

The article of R. Noorda & O. Schlüter (2024) explores the importance of multidisciplinary collaborations for innovation in the publishing sector, specifically how the combination of expertise in fields such as technology, design, and marketing contribute to the development of new forms of publication. The authors highlight how these collaborations can help publishers adapt to digital transformations by integrating cutting-edge technologies such as artificial intelligence and automation. This study is directly related to the current research, as it examines the process of digitalisation in publishing both in Ukraine and abroad, including countries such as China, the USA, Germany, and Poland. In particular, publishers in these countries are actively implementing online services for content distribution and refining business models to monetise e-books. Additionally, there is a shift from traditional printing methods to digital publication formats, which helps reduce costs and reach a wider audience. The experience of foreign countries demonstrates the importance of digital strategies for ensuring the competitiveness of publishing businesses in the market.

Conclusions

The research identified key aspects of the publishing industry's adaptation to the digital revolution, particularly in the context of digital platforms and the distribution of e-books and audiobooks. While the results demonstrate that digital formats are gaining significant traction among Ukrainian consumers, they have not yet become the dominant format in the book market. Quantitative data from the survey of 200 respondents revealed that 20% regularly use audiobooks, while 45% prefer physical books and 35% opt for e-books. Notably, 55% of respondents expressed a willingness to pay for audiobook subscriptions, highlighting the potential of this market segment. An analysis of sales data from Ukrainian publishing houses indicated a steady growth in the share of e-books and audiobooks, especially among the 25-35 age group. Qualitative data from the study revealed both the benefits and challenges of digital transformation. Leading international platforms like Amazon Kindle and Google Books offer a high level of integration for authors and readers but have limitations in localisation for the Ukrainian market. Conversely, Ukrainian publishers such as Nash Format and Yakaboo are actively adapting their models to digital environments but face challenges in competing with global platforms. The findings underscore the importance of developing localised platforms that cater to the specific needs of Ukrainian

consumers and authors. Features such as content localisation tools, enhanced marketing capabilities, and personalised recommendations can significantly enhance the appeal of these platforms. Additionally, audiobooks exhibit significant growth potential, given their convenience and popularity among mobile device users.

Each country examined in the study, including the USA, Poland, Germany, China, and Ukraine, has developed its own regulatory framework to combat piracy and protect intellectual property. While Ukraine's digital transformation of publishing has yielded successful examples like Yakaboo and Nash Format, challenges such as technical limitations and legal restrictions persist. The recent enactment of the Law of Ukraine No. 2811-IX (2022) aims to address these issues by providing a legal framework for effective operation in the digital market and protecting the rights of authors and publishers. Recommendations emerging from the research include investments by publishing houses in digital infrastructure to facilitate integration with international platforms, the development of proprietary mobile applications for promoting econtent, and the active use of digital platforms by authors to publish their works and reach a wider audience. Additionally, government and industry associations should play a pivotal role in fostering the growth of local digital platforms through grants, educational programs for authors and publishers, and support for the export of Ukrainian content. In conclusion, the research has underscored the critical importance of digital transformation for the publishing industry, identifying key challenges and opportunities, and providing practical recommendations for Ukrainian publishers to adapt effectively to the evolving market landscape.

Limitations of the study include a limited sample size, primarily focusing on the 25-35 age group. While this demographic is representative of a significant segment of the market, it does not account for older demographics who may also be potential audiobook consumers. Moreover, the analysis was based on a limited number of platforms and publishing houses, which may not fully reflect the diversity of the market. Future research should focus on long-term consumer behaviour, the competitiveness of local platforms in a global context, and the impact of digital adaptation on content accessibility for different social groups. Additionally, investigating the effectiveness of marketing tools such as personalised recommendations and interactive content is crucial.

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Conflict of Interest

None.

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Адаптація видавничої справи до цифрової революції: стратегії онлайн-видавництва та дистрибуції контенту

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Анотація. Метою було виокремлення основних аспектів просування українських авторів та видань на глобальних платформах. Методологія включала порівняльний аналіз цифрових платформ, кейс-стаді українських та міжнародних видавництв таких країн, як США, Німеччина, Польща, Китай, опитування респондентів, статистичний аналіз даних про продажі та SWOT-аналіз. За допомогою дослідження адаптації видавничої справи до цифрової революції встановлено, що українські споживачі дедалі частіше надають перевагу електронним форматам книжок, особливо аудіокнигам. Зібрані дані свідчили про зростання популярності аудіоконтенту завдяки його зручності та доступності для різних категорій користувачів. У результаті проведеного аналізу було визначено основні тенденції цифрової трансформації у видавничій сфері. Провідні міжнародні платформи, такі як Amazon Kindle, Google Books та Apple Books, продемонстрували високий рівень функціональності, зокрема завдяки зручному інтерфейсу, розвиненим можливостям для монетизації контенту та інтеграції з широкими аудиторіями читачів. Водночас було виявлено, що українські видавництва («Наш Формат», Yakaboo, «Віват») активно впроваджують цифрові стратегії, однак стикаються з певними викликами, пов'язаними з недостатнім рівнем технічного забезпечення та обмеженим доступом до глобальних ринків. Аналіз досвіду цих компаній виявив ключові фактори успішної цифровізації, зокрема важливість адаптації до потреб споживачів, розширення можливостей самостійної публікації та інтерактивної взаємодії з аудиторією. На основі результатів опитування 200 респондентів, було визначено тренди використання аудіокниг, популярні платформи, тематики та поведінкові особливості різних вікових груп. Отримані результати показали, що попит на аудіокниги в Україні має значний потенціал для зростання, особливо серед молодшої аудиторії, яка готова сплачувати за підписку на цифрові платформи. Аналіз функціоналу платформ та досвіду видавництв виявив ключові напрями для вдосконалення цифрових сервісів: локалізація, розвиток маркетингових інструментів та оптимізація взаємодії з користувачами.

Ключові слова: новітні технології; інформаційні платформи; розповсюдження матеріалів; інновації; медіа-бізнес



Innovative approaches to social communication strategies: An analysis of applied technologies

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Abstract. The study aimed to examine the impact of multimedia elements and interactive components on user engagement with content. It was conducted across three leading media platforms: The Guardian, National Geographic, and The Washington Post. The objective was to analyse the influence of multimedia formats and interactive features on audience engagement and the effectiveness of shaping public opinion through content analysis of media platform publications in 2023. In parallel, an assessment of social media was carried out to evaluate audience reactions beyond the primary media resources. The key findings indicated that interactive elements significantly enhance user engagement, fostering active discussions, increasing the number of comments, and encouraging content sharing via social networks. Interaction through surveys, votes, and comments was found to not only attract attention to the material but also deepen understanding and critical reflection on the presented information. On platforms where multimedia formats (such as videos, infographics, and interactive maps) are actively utilised, a significant increase in user dwell time and engagement has been observed. These tools create new opportunities for communication between media outlets and their audiences, enabling media platforms to better respond to user interests and needs. The study also confirmed that multimedia content and interactive elements serve as powerful instruments for shaping public opinion, particularly in an era of high information saturation and rapid global changes. Interactive features not only enhance user engagement but also facilitate the formation of communities around specific topics, amplifying the dissemination of information through social networks and increasing interaction with media content. Media platforms that actively employ these technologies can not only attract attention but also foster deeper connections with their audiences, contributing to the development of more informed and critically engaged public discourse. Methodologically, the study was based on a content analysis of publications on selected media platforms throughout 2023, allowing for the examination of a broad range of topics, including social, political, environmental, and cultural issues

Keywords: journalism; media space; audience; content; interactive technologies; transformation

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Introduction

The digital transformation of the media landscape has become a pivotal aspect of the contemporary information environment, significantly influencing journalism, education, social communications, and the integration of technology into everyday life. In light of this, academic research has been necessary to analyse how digital innovations are changing the professional activities of journalists, educators, and social workers, as well as how they impact communicative interactions between people in the digital age.

Numerous scholars have been engaged in research on this issue, analysing various aspects of digital transformation across different fields. V. Vivona & N. Caranti (2020) explored the impact of digital transformation on the educational process in urban environments. Their analysis demonstrated how digital platforms and educational tools stimulate interactivity in learning, allowing students to receive personalised content and fostering the development of critical thinking. It was established that digital transformation requires teachers to adapt to new teaching methods and utilise technology to create more effective and inclusive learning environments. Key questions included media literacy, critical thinking, and technological competence, which are essential for working in a digital education environment. In her research, O.L. Voznesenska (2019) examined the role of media creativity in fostering social optimism among audiences subjected to media trauma. The researcher analysed the mechanisms by which media content can contribute to maintaining psycho-emotional stability and developing a positive perception of reality in the face of information crises. L. Kostetska & L. Cherniavska (2021) analysed the role of artistic communication in the context of strategic communications. The authors explored how artistic means can be used within strategic communications to foster effective interactions between communication subjects. Particular attention was paid to the importance of artistic communication in processes of social interaction and mutual influence, reflecting the specifics of contemporary strategic communications. O. Al-Zoubi *et al.* (2024) examined the ethical challenges faced by journalists when using artificial intelligence in newsrooms. The researchers analysed the problems arising from the automation of news processes, including issues of accountability for content and potential biases that could emerge when using algorithms to generate news.

A.K. Axelsson *et al.* (2024) investigated methods of social integration of people with congenital deaf-blindness in the digital age. This study identified the need for non-verbal and verbal strategies to ensure effective interaction. The authors emphasised the importance of empathy, patience, and an individual approach in communication. It was shown that properly organised digital technologies and social platforms contribute to greater inclusivity and mutual support, allowing people with special needs to effectively integrate into the

digital community and maintain interpersonal relationships. Thus, these studies have demonstrated that the digital transformation of the media landscape has a multifaceted impact on communication, journalism, and social integration. Thanks to innovative tools and platforms in the fields of education, journalism, and social work, interactive, effective, and inclusive environments have been created. However, these changes require the constant development of professional skills, critical thinking, adherence to journalistic ethics, and a high level of accountability to the audience, which is a necessary condition for successful functioning in the digital age. In a study by I.H. Perdana & I.P.D. Winarto (2024), resilience communication strategies on social media and websites of Thai and international restaurant brands were compared. The research demonstrated how different brands adapt their strategies to various cultural contexts and platforms to engage their audience. S. Varzandeh (2018) analysed the impact of technology on journalism, emphasising the changes that have occurred in the profession due to digital innovations.

The key aspects of interactivity in digital media were explored in the research of D. Zagorulko (2024). The author proposed a classification of interactive functions and analysed their impact on audience engagement. The study emphasised that interactivity creates a dynamic media environment, changing the ways in which content creators and users communicate. Researchers T.A. Trachuk & M.Yu. Andriushchenko (2024) analysed current trends and features of online media functioning in the modern information environment, as well as the impact of technological progress on journalistic activities, and changes in professional practices and communication strategies in digital media. R. Lopes da Costa *et al.* (2022) studied the impact of digital transformation on the media industry, exploring changes in technological processes, content production, and information dissemination. The researchers examined how digitalisation has affected media business models, audience interaction, and the effectiveness of communication strategies in the media industry.

S. Dovgal *et al.* (2020) examined the philosophical aspects of the transformation of the media landscape in the context of digitalisation. The researchers analysed the impact of digital technologies on media culture, communication processes, and information perception. They explored the interplay between technological innovations and changing value orientations in the media space, as well as the impact of these processes on audience perception and journalistic practices. S. Sydorenko (2021) studied the impact of digital transformation on society in the context of the Fourth Industrial Revolution. He analysed changes in the social, economic, and cultural spheres caused by the development of digital technologies and discussed the challenges and opportunities arising from these processes. In the study of



V. Voronkova *et al.* (2023), the features of the formation and development of Society 5.0 were considered, taking into account the social, technological, and cultural aspects of this process. Researchers have analysed the impact of digital innovations on communication, the professional sphere, and interpersonal relationships in the context of rapid digitalisation and the integration of artificial intelligence. I. Baida (2024) analysed the impact of digital culture on media consumption, focusing on changes in audience reactions and the development of new forms of communication. The study examined how digitalisation and media platforms influence cultural values, the media landscape, and consumer practices in various cultural contexts.

All these studies have highlighted the need for a deeper analysis of social communication strategies in the digital age, demonstrating the key role of digital technologies in modern society. They have shown how these technologies facilitate interpersonal integration, cultural exchange, the development of local businesses, and social responsibility. In particular, it was found that digital tools can effectively support intercultural communication, enhance cooperation in the business environment, and promote social responsibility through community engagement. It is important to develop methods and tools that take into account the cultural, social, and individual needs of the target audience, ensuring the successful integration of digital technologies into everyday communication and the professional sphere in a globalised world. The study aimed to assess the impact of multimedia and interactive elements on user engagement and the shaping of public opinion through an analysis of publications on the media platforms The Guardian, National Geographic, and The Washington Post in 2023.

Materials and Methods

A range of materials from three leading media platforms were used for the study: The Guardian, National Geographic, and The Washington Post, which allowed for a wide range of approaches to presenting multimedia content and interactive elements. Each of the selected resources has its own specific characteristics in the context of using interactive components and multimedia formats, which contributed to a comprehensive study of their impact on audience interaction. The Guardian was selected due to its active use of multimedia elements in its publications and interactive content. For the study, articles covering social, political, and environmental topics were selected. The choice was due to the presence of not only traditional text content but also accompanying multimedia elements such as videos, interactive graphics, and infographics, as well as the active use of surveys, votes, and interactive maps.

National Geographic was selected due to its focus on science journalism and the use of multimedia elements to visualise complex information. The articles selected

for analysis cover topics such as environmental issues, climate change, scientific discoveries, and explorations of nature and culture. Particular attention was paid to materials containing interactive maps, graphs, and infographics, as well as virtual tours that allow users to explore different aspects of a topic directly in the online space. The Washington Post was chosen for its combination of traditional approaches to journalism with new technologies, including interactive elements that allow users to delve deeper into the context of events. The articles selected for the study relate to political, economic, and social issues, and include multimedia elements such as videos, infographics, and interactive graphics, as well as the active use of comments, surveys, and social media to engage the audience.

All publications for the study were collected from January to December 2023, allowing for a comparative analysis of trends in the use of multimedia elements and interactive components throughout the year. This approach made it possible to identify key changes in the ways of interacting with the audience through multimedia formats, as well as to assess their effectiveness in terms of engaging and interacting with users. After collecting the content, a detailed analysis was conducted based on several key criteria: the presence of multimedia elements, types of interactive components (including videos, infographics, interactive maps, etc.), frequency of their use, as well as the level of user engagement, measured by the number of comments, likes, shares, and participation in surveys. Thus, the use of materials from three different platforms allowed for a more comprehensive understanding of the impact of multimedia content and interactive elements on media journalism, particularly on the interaction between media resources and their audience.

Several methods were employed in the study to conduct a comprehensive analysis of content interactivity on media platforms and user interaction with this content. In particular, content analysis was used to systematise publications on media platforms such as The Guardian, National Geographic, The Washington Post, BuzzFeed, and BBC News, classifying them by types of multimedia elements (text, video, infographics, podcasts) and interactive components (surveys, votes, comments, other user engagement elements). This method also made it possible to determine the frequency of using interactive elements in publications and to analyse changes in the presentation of interactive content on different platforms. To assess user interaction with content, a quantitative study was conducted, which included monitoring engagement indicators such as the number of comments, likes, shares, and participation in surveys. This allowed for the collection of data on user interaction levels with different types of content (articles, videos, infographics, podcasts) and to determine the impact of interactive components on these indicators. The analysis revealed correlations between content types and the

level of user engagement, as well as to assess how multimedia and interactive elements affect audience activity.

A comparative analysis was used to study the differences in approaches to interactivity on various media platforms. This method involved comparing the frequency of use of multimedia elements and interactive components, as well as analysing the level of user engagement through comments, likes, shares, and votes on each platform. The comparison allowed for the identification of specific strategies for using interactive components and the evaluation of their effectiveness on each platform. To study user interaction with content beyond the main media resources in more detail, an analysis of social media (Twitter, Facebook, Instagram, YouTube) was conducted. This method included monitoring reposts, comments, and discussions that took place on social media regarding publications from media platforms. The analysis made it possible to identify how media content interacts with the audience on these platforms and what strategies are used to engage users outside of the main media resources. Additionally, this method helped to assess the role of social media in shaping engagement and creating additional communication channels that contribute to content dissemination. The collected data was analysed using statistical methods, which allowed for the identification of significant correlations between content types and the level of interaction with it, as well as the evaluation of the effectiveness of using interactive components on different media platforms.

Results

The analysis of interactivity levels in media spaces, using platforms, podcasts, and social media as examples. Interactivity in journalism is a key aspect of the modern media landscape, defining the processes of interaction between media content and the audience, contributing to deeper perception, understanding, and engagement. An analysis of interactivity should be conducted through three main aspects: multimedia, user agency, and gamification in media. First, multimedia is a fundamental element that involves the integration of various information formats such as text, audio, video, and graphics. This combination allows media to make the most of digital technologies to create

comprehensive and dynamic content that can satisfy a variety of information needs and audience interests. Multimedia promotes more effective communication, allowing viewers, listeners, and readers to acquire knowledge through various sensory channels, which in turn improves understanding and retention of material.

The second important aspect is user agency, which involves the active participation of the audience in the creation, exchange, and consumption of media content. The agency is manifested through comments, social media, discussions, and other forms of interactive feedback. Such processes stimulate critical thinking, analytical skills, and contribute to a deeper engagement with media content. The audience does not simply consume information but becomes a participant in the media space, creating a sense of community and interaction. Media, in turn, have the opportunity to better understand the needs and interests of their audience, adapting content to their expectations and preferences.

The third aspect of interactivity in media is gamification, which involves incorporating game elements into journalistic content and media projects to increase interest and audience engagement. Gamification includes tasks, quizzes, competitions, leaderboards, and other elements that encourage the audience to actively participate and spend more time in the media space. This helps the audience better understand complex content and also encourages them to learn new information and develop critical thinking. Gamification not only provides entertainment but also fosters long-term audience loyalty, making the process of interacting with media more effective and meaningful. An example of gamification that fosters long-term audience loyalty is the use of game elements on media platforms, such as tasks, quizzes, leaderboards, and points. This approach encourages users to return to the platform, maintains their interest, and builds long-term loyalty to the content, as each new level achieved or competition won gives a sense of progress and motivation for further active participation. Therefore, interactivity in journalism, through the aspects of multimedia, user agency, and gamification, creates more integrated and rich content that meets the needs of modern audiences. Figure 1 provides a more detailed overview of the interaction between these components.

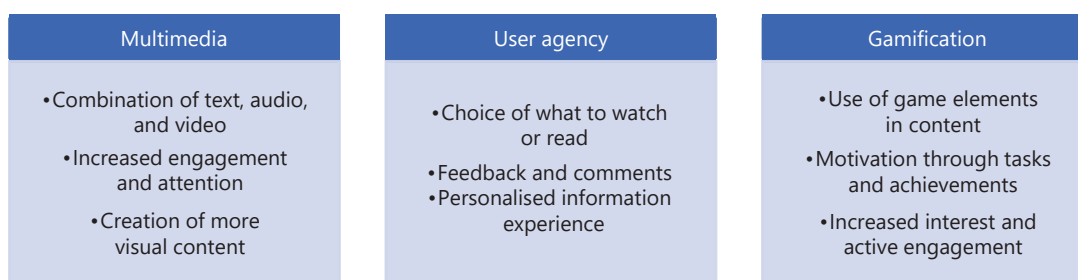


Figure 1. Aspects of interactivity in modern journalism

Source: provided by the authors



Such approaches allow media to improve the effectiveness of information transmission, promote the development of critical thinking and analytical skills in the audience, and support active and constructive interaction between media content and consumers, making the media space more interactive, dynamic, and meaningful for modern society. Multimedia is one of the key components of interactive content in modern journalism, involving the integration of various information formats – text, graphics, video, and audio – into a single structure. This combination allows for the creation of richer and more informative content that effectively conveys information to the audience, improves understanding of complex material, and stimulates a deeper level of engagement and interest in media content.

The combination of text, graphics, video, and audio allows media to utilise various sensory channels of perception, ensuring more effective information absorption. For example, in The Guardian's media projects, multimedia is implemented through the integration of text with visual infographics and graphics. Thanks to this, complex social and economic aspects become more understandable for the audience. Infographics and visual data allow for a quick and accurate understanding of key aspects of information, which is especially important for understanding statistical data and economic trends. In National Geographic projects, multimedia is used to explain complex natural and scientific concepts through 3D visualisations, audio-visual materials, and infographics. Such tools allow for a better understanding of geological processes, biological phenomena, and physical aspects of nature. For example, video materials supplemented with 3D modelling allow the audience to perceive complex concepts more intuitively and quickly, comparing theoretical knowledge with practical visualisations.

Podcasts and video content on platforms like YouTube also demonstrate the effectiveness of multimedia in explaining complex topics. Here, textual explanations are combined with audio and visual elements, allowing for better transmission of the emotional colour and content of the material. The use of different media formats helps to increase the attention of viewers and listeners, making the material more accessible and understandable. Audio, in particular, adds emotional colouring, which helps to better convey important points or create the desired mood. Visual elements such as graphs, infographics, animations, or illustrations support the perception of information, making it easier to grasp complex concepts, such as technical or scientific data.

This integrated approach to information delivery allows for effective interaction with different types of audiences who may have different preferences for how they learn. For example, some people may better understand the material through hearing, others through visual images, and still others by combining both aspects. Additionally, platforms like YouTube allow for

interaction through comments or likes, enabling feedback and the adaptation of content to meet audience needs. This creates a cyclical process of improving material, making it even more accessible and relevant. Thus, a multimedia approach on platforms such as YouTube or in podcasts can significantly improve the effectiveness of learning and acquiring new information, as well as making this process more enjoyable and engaging for listeners and viewers. Therefore, multimedia in modern journalism is a necessary condition for interactive content, which promotes deeper understanding of information, improves the analytical skills of the audience, and stimulates critical thinking. By integrating text, graphics, audio, and video into a single structure, media content becomes more accessible, understandable, and interactive. This ensures the effective delivery of information, creates active interaction between the audience and the media space, and promotes constructive knowledge exchange in modern society.

One significant manifestation of user agency is the use of interactive simulations that allow audiences to visualise complex data and processes clearly and intuitively. For instance, in projects by The New York Times, interactive simulations are used to demonstrate economic processes such as inflation or the labour market. Users can change parameters, observe results, and make predictions, allowing them to better understand the dynamics of economic phenomena and effectively analyse data. Such simulations foster the development of analytical skills and critical thinking, and also enable audiences to appreciate the complexity of economic processes that often seem intangible or abstract.

Another example of user agency is the use of 360-degree videos in news projects, such as those by the BBC. In the context of covering significant events, like armed conflicts or natural disasters, 360-degree videos allow the audience to experience the true scale and atmosphere of events. Viewers can rotate the camera in any direction, observing the situation from all angles. This contributes to a deeper emotional perception and understanding of the context of events, creating a sense of presence at the scene and allowing for a better assessment of the real conditions and scale of the disaster. Such technologies help to foster empathy, critical thinking, and analytical skills, as well as stimulate more active discussion and social interaction in the media space. User agency is also realised through social media and feedback tools. In the modern media landscape, platforms like Twitter or Instagram allow the audience not only to comment on and share information but also to create their own content, discuss news, and influence its meaning. For example, hashtags and trends on social media demonstrate the community's ability to influence the news agenda and highlight important social and political issues. This creates a media space where the audience does not simply consume information but becomes a vital

participant in media content, influencing its distribution, interpretation, and perception.

Gamification in media is a key element of interactivity, aimed at incorporating game mechanics into regular journalistic content to stimulate active audience engagement and increase involvement. This not only helps to increase interest in the content but also contributes to a deeper understanding of topics and creates a more interactive experience for the user. Gamification uses game-like incentives, such as points, missions, levels, tasks, achievements, and other elements that stimulate motivation, encourage the achievement of specific goals, and create visual and emotional interest. In The Guardian's media projects, for example, gamification is applied through interactive tasks and puzzles where users can collect data, solve problems, and visualise complex information. This allows for a deeper understanding of social and economic issues, such as analysing financial reports or solving social puzzles. As a result of such tasks, the audience not only receives important information but is also actively involved in the process of its analysis and interpretation, developing analytical skills and critical thinking.

Another striking example is BuzzFeed media projects, where gamification is implemented through interactive quizzes and surveys. Here, users can test their knowledge, learn about their preferences and interests through personalised test results, and also receive incentive points and recognition. Such mechanics allow media to better understand audience psychology, determine reader preferences and interests, and accordingly adapt content to their individual characteristics. They also contribute to a high level of engagement

and encourage users to spend more time on the platform, interacting with content and completing tasks. Gamification also allows for the creation of a community around specific content, where participants share achievements and results. For example, on social media platforms like Reddit or TikTok, gamification is implemented through voting and rating systems. This encourages users to be active community members, share thoughts and content, and fosters an interactive community environment.

Interactivity in contemporary media spaces plays a crucial role in the transmission and perception of information. Through the integration of text, graphics, audio, and video, media content becomes more accessible and understandable to the audience, stimulating analytical thinking and critical information perception. Modern media projects demonstrate how interactivity contributes to a deeper understanding of complex processes, be they economic, social, or technological aspects. Projects by media outlets such as The New York Times, The Guardian, and BuzzFeed, as well as social platforms and technology projects, showcase the effectiveness of interactive content in clarifying complex topics and data. Simulations, data visualisations, gamification, and 360-degree videos allow audiences not only to consume information but also to actively interact with it, make predictions, analyse data, and express their opinions. Table 1 demonstrates the key aspects of interactivity in media projects. It analyses the features of using simulations, data visualisations, gamification, and social interactivity, which collectively develop analytical skills, critical thinking, and the ability to work with information in the modern media landscape.

Table 1. Comparative table of interactivity in media spaces through examples of platforms, podcasts, and social media

Criterion	The New York Times	Podcasts and YouTube	The Guardian	BuzzFeed	Social media (Twitter, Reddit, TikTok)
Interactive simulations	Economic process simulations (labour market, inflation)	None	None	None	None
Visualised data	Dynamic graphs and interactive infographics	Animations and video content	Interactive infographics	Visualised puzzles and interactives	Animations, GIFs, visualised posts
Gamification	Data analysis tasks and interactive predictions	None	Puzzles and interactive tasks	Quizzes, tests for fun and knowledge	Voting, rankings, reward systems
User agency	Ability to test predictions and parameters	Limited interactivity	User interaction with analytical tasks	Surveys and interactive engagement	Content creation participation, voting
Emotional perception of content	Analysis through data and predictions	Emotional perception through audio and video content	Social puzzles and analytical perception	Personalised quizzes based on interests	User reactions and discussion community

Continued Table 1.

Criterion	The New York Times	Podcasts and YouTube	The Guardian	BuzzFeed	Social media (Twitter, Reddit, TikTok)
Social effect of interactivity	Influence on understanding of economic realities	Exchange of opinions in comments	Analytical social interaction	Encouragement of exchange of thoughts and community	Social surveys, hashtags, trends, discussions
Integration of media formats	Text, graphics, data, animations	Audio, video, text	Text, video, interactive infographics	Text, video content, and interactivity	Text, video, GIFs, voting, audio content
Data analysis and predictions	Analytical simulations, predictions for the audience	Minimal data analysis	Analysis through tasks and puzzles	Visualised data and interactive tasks	Data exchange, trends in Reddit, TikTok
Development of critical thinking	Data analysis and predictions	Limited critical reflection	Social analysis and analytical tasks	Analysis through interactives and quizzes	Participation in discussions, critical debates, and content analysis
Audience interactivity	Engagement through predictions and analytical tools	Consumption of content through audio and video	User problem-solving tasks and interactive infographics	Active engagement in quizzes and tasks	Participation in communities, voting, content creation

Source: provided by the authors

Interactivity in media significantly impacts the audience, and this influence is manifested through several important aspects. Engaging attention and maintaining interest are fundamental elements of interactive content. While traditional text formats require more time to comprehend, interactive formats facilitate quick and intensive information perception. For example, in The Guardian's web projects, the integration of text, video, and infographics allows readers to instantly grasp key facts and their context. The perception of complex content is significantly facilitated by the use of interactive simulations and 3D visualisations. They provide users with the opportunity to experiment with data, obtain predictions, and observe results in real time. This makes scientific or social information more accessible, even for audiences without specialised knowledge.

The social interaction facilitated by interactive elements contributes to the formation of public opinion and the identification of audience reactions. Through surveys, votes, and other interactive mechanisms, journalists gain valuable insights into readers' interests. For example, BuzzFeed actively uses quizzes and surveys to engage the audience and gather feedback. Interactivity in journalism is becoming a key tool for attracting attention, explaining complex information, and building relationships with the audience. The integration of multimedia solutions, user engagement features, and gamification enables the creation of content that is both

informative and emotionally engaging, fostering deeper understanding and sustained interest.

Results of the analysis of interactivity in media spaces. The Guardian actively used a variety of interactive elements in its content, which contributed to user engagement and stimulated their interaction with materials. These elements included comments, surveys, and votes, as well as multimedia components such as videos, graphics, and infographics. The use of such formats allowed not only for the transmission of information but also encouraged readers to actively participate in discussions, provide ratings, or express their opinions on the covered topics. Engaging users through interactivity helped not only to deepen the perception of information but also created additional opportunities for interaction with the content.

Articles on The Guardian platform were the most interactive. They were regularly accompanied by surveys, votes, and comments, allowing users to participate in developing discussions. Most articles covered current social, cultural, and scientific topics, which provoked a high level of engagement. For example, publications on topics related to international events or social issues received a large number of comments where users discussed different viewpoints and offered their perspectives. Figure 2 illustrates examples of user comments on The Guardian platform, demonstrating their participation in discussions.

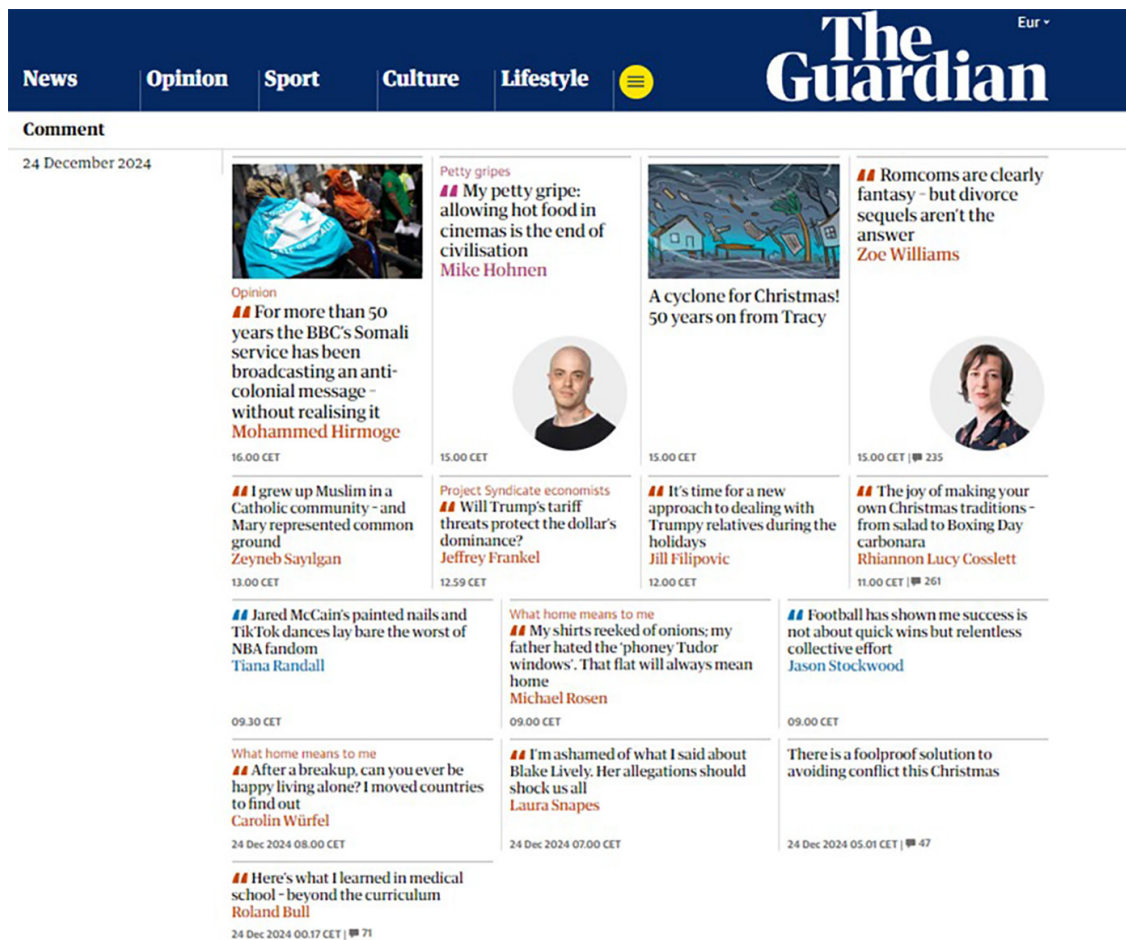


Figure 2. Examples of comments on The Guardian platform

Source: provided by the authors

This helped create additional value for the content, as it not only informed but also stimulated the exchange of ideas among a wide audience, thereby creating a dynamic social platform for discussions. Video content was also actively used to attract user attention. Videos

typically complemented articles or presented material in the form of reports and documentaries. Figure 3 illustrates the use of interactive elements, such as voting and commenting buttons, which allowed users to express their opinions on the presented material.

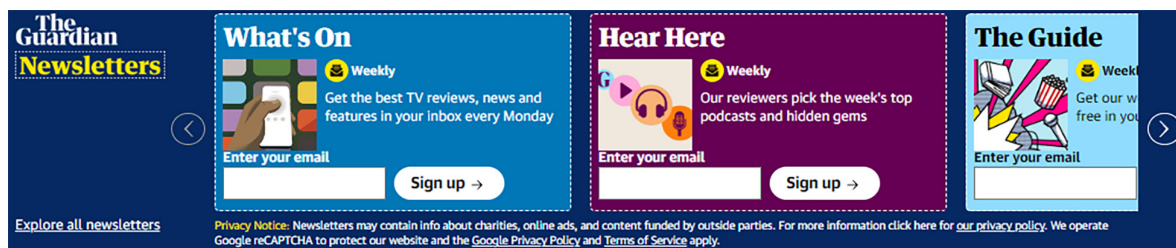


Figure 3. Interactive elements with voting and commenting buttons on The Guardian platform

Source: provided by the authors

This approach significantly increased the level of interaction with the material, as users could not only rate the video but also actively participate in discussions of the issues raised in the video. The interactivity of such content significantly enriched the discussions around the video, stimulating broader engagement with the topic. Podcasts on the platform played an important role

in engaging listeners as they created a more personal and intimate connection with the audience. Figure 4 demonstrates The Guardian podcasts, which were characterised by a high level of interaction through social media, allowing listeners to leave thoughts, questions, and discuss topics, although direct interactivity during listening remained limited.

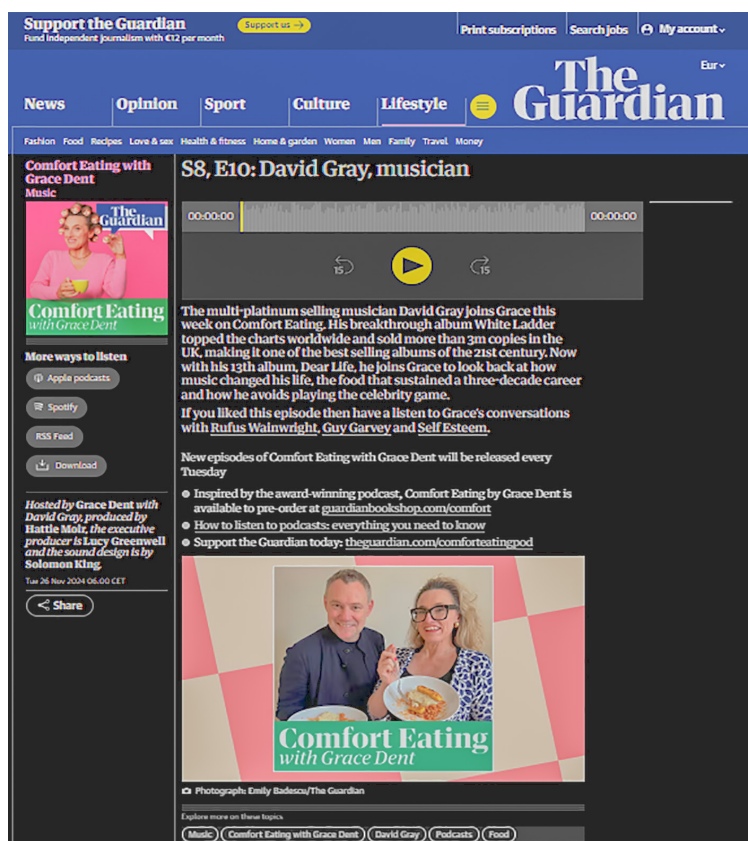


Figure 4. Listener interaction with The Guardian podcasts

Source: provided by the authors

This integrated use of various content formats allowed the platform to create diverse channels for feedback and audience engagement in discussions, significantly increasing the effectiveness of The Guardian's communication strategy. Table 2 presents data on user interaction with different types of content published on the platform during the research period. It includes

information on the number of publications, as well as the average number of comments, likes, shares, and interactions with polls for each content type. This data allows for an assessment of the level of audience engagement and the effectiveness of using different content formats, which contributes to the formation of social communication strategies.

Table 2. Parameters of interactivity of media content on The Guardian platform during the research period

Content type	Number of publications (during the research period)	Average number of comments	Average number of likes	Average number of shares	Average interaction with surveys
Articles	10	500-1000	7,000-10,000	5,000-7,000	10,000-15,000
Videos	5	300-500	5,000-7,000	3,000-5,000	5,000-7,000
Podcasts	5	200-300	1,000-2,000	1,500-2,500	1,000-2,000

Source: provided by the authors

Overall, the integration of multimedia elements, video content, podcasts, and interactive elements allowed the platform to significantly increase user engagement and foster the formation of communities for exchanging ideas. This is an example of innovative approaches to social communication strategies that effectively use modern technologies to engage and interact with the audience. The National Geographic platform actively used multimedia elements to engage its audience, including interactive maps, videos, and infographics. These elements allowed users to interact with materials

more deeply, which was particularly suitable for topics related to science and ecology, as these issues require accurate data and clear visual representation. Every publication on the platform was not limited to text materials but included interactive tools that allowed users to better understand complex issues and actively participate in the process of content perception. Figure 5 illustrates the role of video content in engaging users, particularly through documentaries and reports, which effectively complemented articles and attracted significant audience attention (Fig. 5).

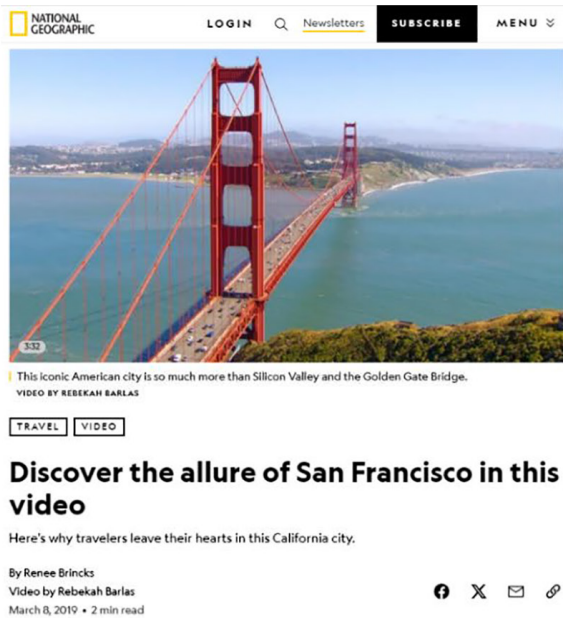


Figure 5. Engaging the audience through video content
Source: provided by the authors

Interactive elements such as maps and graphics became important tools for interaction. They allowed not only to view data but also to actively interact with it, which increased user interest in the content. Figure 6 demonstrates the use of infographics and interactive maps in articles, allowing users to change parameters and visualise the impact on the situation in different regions, thereby increasing their engagement.

Pacific conveyors

Ocean currents could carry treated radioactive wastewater far from the Fukushima Daiichi nuclear power plant. Scientists in some countries around the Pacific worry about its potential effects on food chains and ecosystems.

- Pacific Ocean current
- Fukushima Daiichi nuclear power plant

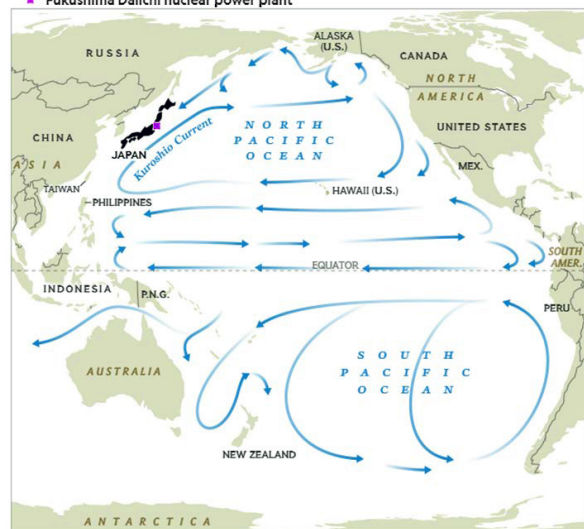


Figure 6. Interactive maps and infographics in articles on The Guardian platform
Source: provided by the authors

These effectively demonstrated complex scientific data, allowing users to better understand the information. For example, interactive maps showing climate change enabled comparisons of different scenarios and assessments of how these changes impact various regions in real time. Publications on environmental topics, in turn, were supplemented with multimedia materials, making the study of such issues more efficient and convenient for users. Figure 7 illustrates the engagement of the National Geographic audience through comments, likes, shares, and surveys, which contributed to the formation of a community of like-minded individuals for the active discussion of scientific and environmental issues.

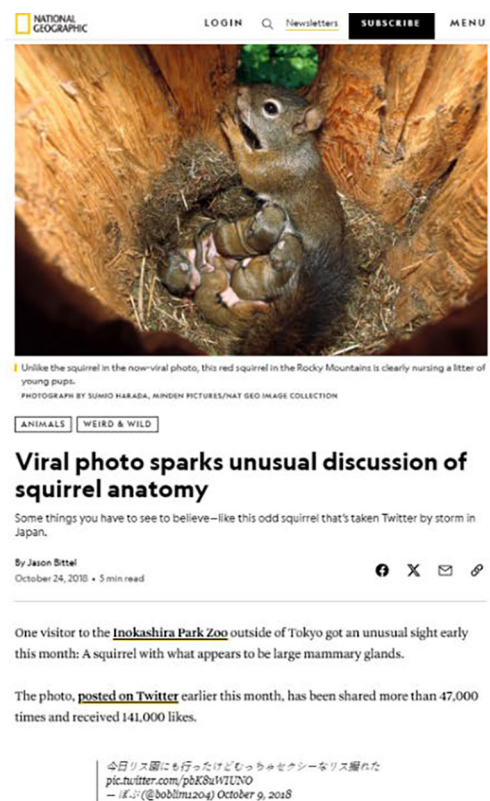


Figure 7. Active engagement of the audience through comments, likes, shares, and surveys on the National Geographic platform
Source: provided by the authors

Comments became an important feedback channel, allowing the platform to assess the audience's reaction to various publications. Sharing materials on social media and participating in polls also indicated a high level of interaction and interest of users in scientific and environmental topics. Thus, the integration of innovative approaches to social communication strategies not only increased interest in the content but also actively stimulated social interaction and engaged a wide audience in addressing important global issues (Table 3).

Table 3. Parameters of interactivity of media content on the National Geographic platform

Content type	Number of publications (during the research period)	Average number of comments	Average number of likes	Average number of shares	Average interaction with surveys
Articles	10	400-600	7,000-9,000	4,000-6,000	2,000-4,000
Videos	5	100-200	4,000-6,000	2,500-4,000	1,000-2,000
Interactive elements	5	300-500	5,000-7,000	3,000-5,000	2,000-3,000

Source: provided by the authors

Overall, National Geographic effectively used multimedia and interactive elements to engage its users, increasing interest in complex scientific and environmental topics. This approach not only deepened the interaction with content but also created a more complete experience for users, providing them with new opportunities for learning and exploration. The Washington Post

actively used multimedia content, including videos and infographics, which significantly improved the perception of materials, providing additional depth to complex social, economic, and cultural topics. Figure 8 demonstrates the use of interactive elements, such as polls and surveys, on the platform, which contributed to increased user engagement.



Figure 8. Implementation of interactive elements on the platform

Source: provided by the authors

This allowed not only to discuss important topics but also to participate in creating the context for further materials, receiving feedback from the audience. Additionally, the active use of social media allowed for quickly engaging a wide audience and increasing the level of interaction with content. One of the key aspects of the platform was interactive elements. They included voting, surveys, and interactive graphics, which allowed users to actively interact with the content. Such interaction made it possible not only to

obtain information but also to influence the further development of the material. Interactive components also allowed users to compare different data, explore new aspects of materials, and receive feedback, significantly increasing engagement. Figure 9 illustrates The Washington Post's innovative approaches to audience interaction through the use of big data and automated recommendation systems, which allow for content personalisation and highlights the importance of comments as a feedback tool.

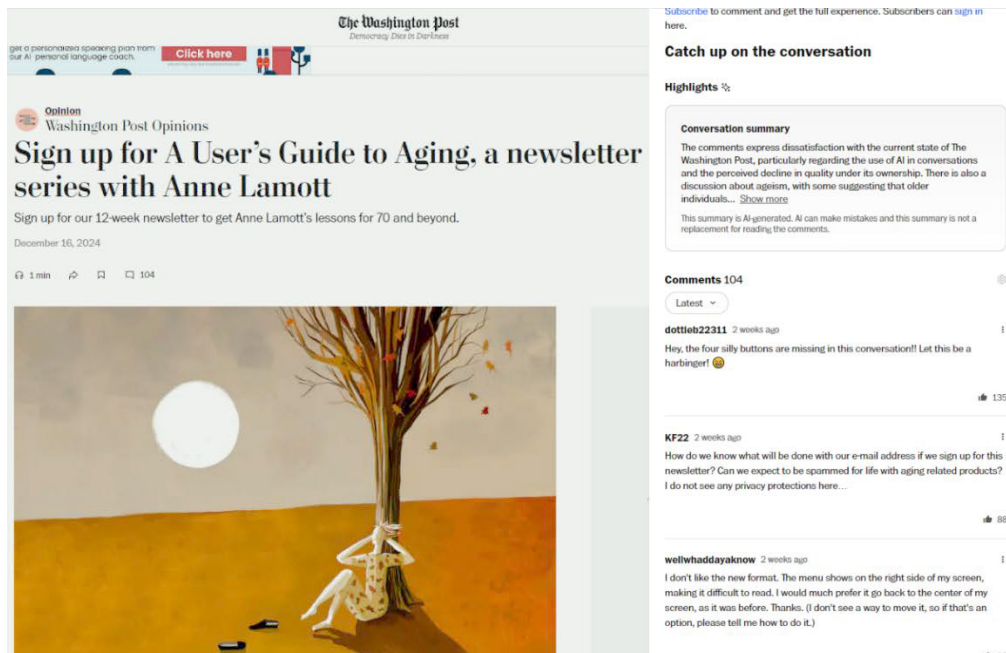


Figure 9. Innovations in audience interaction: big data analysis and automated recommendation systems

Source: provided by the authors

The platform also encouraged active sharing of content through social media, which helped attract a new audience and increase the reach of publications. Participation in surveys and votes further increased user engagement, allowing them to actively interact with the material and shape its context. The Washington Post's innovative approaches to social communication strategies have significantly changed traditional media interaction

methods, particularly through the integration of new technologies, which not only improves the content consumption experience but also effectively influences public opinion and social processes. They have shown how media can actively use interactive elements to increase audience engagement and create a context for further discussions, which is a key aspect of successful social communication strategies in the modern digital environment (Table 4).

Table 4. Parameters of interactivity of media content on The Washington Post platform

Content type	Number of publications (during the research period)	Average number of comments	Average number of likes	Average number of shares	Average interaction with surveys
Articles	10	600-1000	5,000-7,000	3,000-5,000	4,000-6,000
Videos	5	200-400	3,000-5,000	2,000-3,000	1,500-2,500
Interactive elements	5	300-500	4,000-6,000	2,500-4,000	1,000-2,000

Source: provided by the authors

The Washington Post successfully integrated multimedia and interactive elements into its content to increase reader engagement. The use of videos, infographics, and interactive components helped make materials more accessible and understandable to the audience. By implementing votes, surveys, and social media, the platform was able to create an interactive space that fostered active discussion, content sharing, and

attracted new users. All these elements of interaction ensured a high level of audience participation and effectively engaged them in discussions of important social and economic issues. Table 5 presents an analysis of the innovative approaches and technologies used in the media spaces of The Guardian, National Geographic, and The Washington Post to engage audiences and enhance content interactivity.

Table 5. Innovative approaches and technologies in media spaces of platforms

Platform	Type of innovative approaches	Use of technologies	Interactivity and audience engagement	Social media strategies	Technologies for analysis and feedback
The Guardian	Personalised news, interactive platforms, AI analysis	Integration of artificial intelligence for content personalisation	High engagement through comments, likes, shares, interviews, and surveys	Strong presence on social media, integration with Twitter and Facebook	Use of AI for comment and social media analytics, feedback through surveys

Continued Table 5.

Platform	Type of innovative approaches	Use of technologies	Interactivity and audience engagement	Social media strategies	Technologies for analysis and feedback
National Geographic	Use of AR/VR, infographics, interactive maps	Virtual reality for presenting environmental topics, interactive maps	Interaction through visual elements, engagement through long-term multimedia projects	Close collaboration with scientific influencers, active on Instagram	Identifying trends via social media, reader surveys on preferences
The Washington Post	Machine learning for content analytics, automation	Artificial intelligence for data analysis and content recommendations	Use of infographics and videos to explain complex topics	Active use of Twitter and YouTube for content distribution	Analytics through AI for content personalisation and improving comment interaction

Source: provided by the authors

The collected data has shown that interactivity is a crucial tool for audience engagement and depends on the type of content, the multimedia elements used, and interactive components such as voting, surveys, comments, and shares. The overall trend showed that The Guardian makes the most use of comments and polls, which promotes active reader participation in the news discussion process. At the same time, the platform actively integrates video and infographics, which increases engagement and encourages user interaction. It also showed a high level of activity in the sports and culture sections, where interactivity through comments and voting reaches large volumes. National Geographic, in turn, focuses on multimedia elements such as interactive maps, infographics, and videos, which significantly increases the depth of user interaction with content, especially in topics related to ecology and science. The platform also actively uses social media to promote its publications, which helps to attract a wide audience. The Washington Post demonstrates a high level of interactivity through publications that combine text materials with infographics and videos. The platform particularly effectively uses social media to engage users, allowing it to quickly respond to current events and ensure a large flow of comments and interactions with materials (Patriak, 2024).

In conclusion, it can be inferred that interactivity in media spaces is a key factor in user engagement. The use of multimedia elements such as videos, podcasts, and infographics, combined with the ability to comment, vote, and participate in surveys, allows for a high level of interaction and ensures active discussion and content sharing. An evaluation of this interaction has shown that platforms with a high level of interactivity have a significantly higher level of audience engagement, indicating the importance of integrating interactive features into modern media spaces to support active user participation.

Discussion

This study analysed the interactivity of the platforms The Guardian, National Geographic, and The Washington Post, focusing on their strategies for engaging audiences through comments, social media, visual content, and personalised recommendations. The Guardian

actively uses social media to stimulate discussions and create a community, National Geographic engages users through visual content, and The Washington Post employs advanced recommendation technologies to adapt content to users' interests and devices. Thus, the conducted research confirmed that effective interactivity in media spaces depends on well-chosen content strategies, active use of personalised recommendations, social media tools, and visual design. Modern media platforms demonstrate how technology can combine visual, textual, and interactive components to create a unique and effective user experience. Such strategies allow platforms to maintain competitiveness, engage audiences, and create a real community around content, making the media space more interactive and dynamic. The analysis was conducted in a comparative aspect with the results of other scientific studies, in particular with the articles of G. Lăzăroiu (2009), G. SantosHermosa *et al.* (2022). The research revealed that interactivity in media spaces depended on the combination of various media formats. These included text, audio, and video, which together formed unique media content. As a result of integrating these formats, opportunities were created for two-way communication between platforms and audiences. For example, on The Guardian platform, it was observed that the audience actively commented on news and reposts, discussing current events and expressing their opinions. Such functionalities contributed to the formation of an active user community where everyone could join the discussion and contribute to it. An important role in the research was played by the interactivity tools used to stimulate user activity. These included the functionality of comments, the ability to like and share content, and other social tools that allowed the audience to interact with content and each other. These tools not only supported discussions but also fostered audience loyalty to the platforms through emotional connection and community engagement.

S. Robinson *et al.* (2019) examined the issue of personalised recommendations used in digital journalism to enhance user experience. Such recommendations allowed platforms to offer content that matched the interests of individual users. This was also observed on

the National Geographic platform, where algorithms selected articles and video content according to audience preferences. This personalised use of content significantly increased user interest and engaged them in active interaction. The research particularly emphasised the combination of old textual interpretations with modern digital environments to improve intercultural communication, as noted in the study of T. Kitsak & M. Lylyk (2023). The Washington Post platform applied the integration of media content with social media, creating a two-way connection between users and media content. This combination facilitated the globalisation of communication and the exchange of cultural information, creating a platform for intercultural communication.

The research confirmed that interactivity in media spaces depends on the effective combination of various media formats – text, audio, and video, which together create unique and engaging media content. Such integrated approaches create a two-way interaction between platforms and audiences, allowing users to actively participate in discussions, express opinions, and interact with each other. This was particularly evident on The Guardian platform, where commenting and sharing functionalities contributed to the creation of an active community where everyone could contribute to the discussion and exchange of ideas. Interactivity tools such as comments, likes, and shares, as well as other social features, played a key role in building audience loyalty. They not only stimulated discussions but also created an emotional connection between platforms and their users, increasing brand loyalty and engagement with content. Considering the research of G. Lăzăroiu (2009), the integration of old textual interpretations with modern digital environments to improve intercultural communication was noted. This was particularly evident on The Washington Post platform, where an integrated approach between media content and social media was used. Such a combination fostered intercultural information exchange, created a globalised communication space, and facilitated the exchange of cultural information between different audiences.

The study of G. Santos-Hermosa *et al.* (2022) focused on interactivity in digital journalism, exploring the impact of technological tools on the interaction between journalists and audiences. The authors analysed various forms of interactive elements, including videos, interactive graphics, surveys, and other interactive formats, allowing users to interact with content on a new level. They emphasised the changing approaches to creating and disseminating news content, driven by digital innovations. The main focus was on how interactivity affects audience engagement, trust in content, and its perception level. The conducted research also focused on interactivity but had a more applied nature, analysing specific media platforms – The Guardian, National Geographic, and The Washington Post. Unlike the article

of G. Santos-Hermosa *et al.* (2022), where interactivity was studied in the general context of digital journalism, the conducted research considered practical examples of integrating multimedia formats into publications. Additionally, the conducted research provided a quantitative assessment of audience activity using metrics such as likes, comments, shares, and participation in surveys, allowing for an evaluation of the effectiveness of interactive elements with specific indicators. An important aspect of the difference was that the conducted research compared platforms based on the types of interactive formats and their impact depending on the content topic, which made it possible to evaluate the individual strategies of each platform.

The research of M.B. Fauzan *et al.* (2024) explored the impact of digital technologies on the transformation of traditional journalism methods. The main focus was on changes in the ways of collecting, processing, and disseminating information, which were driven by new technologies. The authors analysed how digitalisation transformed the paradigm of journalism, making it more interactive and audience-oriented. A significant part of the research was directed towards understanding how digital platforms change the interaction between journalists and their audiences. The conducted research also considered the transformations in journalism under the influence of digital technologies, but had a more applied nature, focusing on specific media platforms. While the study of M.B. Fauzan *et al.* (2024) analysed general changes in the journalism paradigm, the conducted research focused on the practical aspects of using multimedia formats and interactivity. In particular, it analysed how elements such as interactive graphics, videos, and surveys contribute to user activity and building trust in content. Additionally, the conducted research provided a quantitative analysis of audience interaction through metrics, which allowed for a more accurate assessment of the effectiveness of interactive components on each platform.

The article by M.I. Sultan & A.S. Amir (2023) analysed the ethical challenges of digital journalism related to trust, transparency, and content impartiality. The authors highlighted that journalists must adapt to rapid technological changes, considering the new demands of the audience and the challenges arising in the digital space. Significant attention was paid to how digital technologies transform approaches to news creation and interaction with users, forming new ethical frameworks. The conducted research, also considered the topic of trust in content but focused on interactive components that affect audience activity. However, unlike the research of M.I. Sultan & A.S. Amir (2023), the conducted study did not analyse issues of transparency or impartiality related to content. The main focus was on how interactive elements such as surveys, videos, and interactive maps increase user engagement and contribute to building trust in platforms.



The article of N. Maleyeva (2019), A.F. Sonni *et al.* (2024) investigated the impact of artificial intelligence on digital journalism, particularly on news creation processes and the transformation of editorial practices. The authors highlighted the ethical challenges arising from the use of AI, including issues of content authenticity, bias, and journalistic social responsibility. While the conducted research did not address the issue of artificial intelligence, both studies explored how technology is changing journalism and interaction with the audience. The conducted research focused on interactive elements such as multimedia graphics and interactive maps and their impact on user activity. R. Salaverria (2019) analysed the 25-year development of digital journalism, focusing on key changes in professional practices, ethics, and technologies. The author covered a broad historical context, examining how digitalisation has transformed the media landscape and audience interaction. While the conducted research had a shorter time frame (only 2023), it provided a deep analysis of current trends in the use of multimedia formats and interactivity. Unlike the generalised approach by R. Salaverria (2019), the conducted research focused on specific media platforms and their strategies for audience engagement. This allowed for a detailed picture of how contemporary platforms adapt to the challenges of digitalisation through interactive elements. The conducted research was distinguished by its focus on the practical analysis of interactive elements in the content of specific platforms. Other studies often had a conceptual nature or analysed broader aspects of digital journalism, such as ethics, technology, or historical development, while the conducted research focused on assessing the effectiveness of multimedia in the current context.

■ Conclusions

The research on interactivity in media platforms has shown the importance of multimedia elements in engaging audiences and activating interaction with content. The Guardian platform actively used infographics, interactive maps, videos, and surveys, which contributed to a deeper understanding of the material by users and the formation of public opinion. These elements allowed users to become more active and increase the level of interaction with content, as well as create a community where everyone could express their opinions. Interaction through comments and interactive polls activated the process of forming public opinion, confirming the high level of user engagement. Interactive elements have become important tools for media that aim not only to inform but also to engage the audience in active discussion and decision-making.

National Geographic effectively utilised multimedia elements, including interactive maps, graphics, and virtual tours, to visualise complex scientific and

environmental issues. This allowed users to actively engage with the study of topics such as climate change and biodiversity, making scientific information more accessible and understandable. Visual content combined with interactive elements increased users' emotional response and awareness, which is crucial in the context of global environmental challenges. The Washington Post combined traditional journalistic approaches with interactive elements, including videos, infographics, and graphics. The platform's website actively used commenting, voting, and social media integration features to create dynamic discussions. This allowed users not only to interact with content but also to participate in shaping public opinion on important socio-political issues. Interaction through comments, voting, and social media enabled users to express their views, discuss problems, and actively participate in political discussions. Such interactive elements contributed to a better understanding of complex social issues as they allowed users to obtain a more diverse range of information and opinions on events.

Overall, interactivity across all three platforms facilitated a deeper engagement with the content, although the specific application of multimedia elements varied depending on the genre and target audience. The most effective strategies for engaging users involved combining multimedia elements with social interaction elements such as comments, voting, and sharing. The role of social media as additional channels for content interaction was also significant, allowing not only to attract new users but also to retain existing ones. The main finding of the research is the confirmation of the importance of multimedia and interactive components for engaging and retaining audiences. They not only facilitate information perception but also actively shape communication between media and users. This indicates the importance of integrating various technologies to create more dynamic and interactive content, allowing media to retain the attention of digitally-oriented audiences. Further development of media strategies involves strengthening interaction through social media and engaging new technologies for interactivity.

Future research perspectives include studying changes in media technologies after 2024, as well as developing models of interactivity that can improve communication effectiveness in different cultural contexts. Additionally, it is important to study the impact of new media technologies such as artificial intelligence on interactivity and user interaction in the context of media strategies and their influence on public opinion.

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■ Conflict of Interest

None.

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Інноваційні підходи до соціально-комунікаційних стратегій: аналіз прикладних технологій

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Анотація. Дослідження було спрямоване на вивчення впливу мультимедійних елементів та інтерактивних компонентів на взаємодію користувачів з контентом. Воно було проведено на трьох провідних медіа-платформах: «The Guardian», «National Geographic» та «The Washington Post». Завданням дослідження було проаналізувати вплив мультимедійних форматів та інтерактивних елементів на залученість аудиторії і ефективність формування громадської думки через контент-аналіз публікацій на медіа-платформах у 2023 році. Паралельно з цим було здійснено аналіз соціальних мереж для оцінки реакцій аудиторії поза межами основних медіа-ресурсів. Основні результати дослідження показали, що інтерактивні елементи значно підвищують рівень залученості користувачів, стимулюючи активні обговорення, зростання кількості коментарів та поширення контенту через соціальні мережі. Виявлено, що взаємодія через опитування, голосування та коментарі дозволяє не лише привернути увагу до матеріалу, але й поглиблює розуміння та критичне осмислення представленої інформації. Зокрема, на платформах, де активно використовуються мультимедійні формати (відео, інфографіка, інтерактивні карти), спостерігається значне збільшення часу перебування користувачів на сторінці та їхньої активності. Ці інструменти створюють нові можливості для комунікації між медіа та аудиторією, що дозволяє медіа-платформам краще реагувати на інтереси та потреби користувачів. Також дослідження підтвердило, що мультимедійний контент і інтерактивні елементи є потужними засобами формування громадської думки, особливо в умовах сучасної інформаційної насиченості та швидких змін у глобальному середовищі. Інтерактивні елементи не лише сприяють залученню користувачів, а й допомагають створювати спільноти навколо певних тем, посилюючи ефект поширення інформації через соціальні мережі та збільшуючи рівень взаємодії з медіа-контентом. Медіа-платформи, що активно використовують ці технології, здатні не лише привертати увагу, але й забезпечувати глибший контакт із своєю аудиторією, що сприяє формуванню більш обґрунтованої та критичної громадської думки. Методологічно дослідження базувалося на контент-аналізі публікацій на обраних медіа-платформах протягом 2023 року, що дозволило охопити широкий спектр тем, зокрема соціальні, політичні, екологічні питання та культурні дослідження.

Ключові слова: журналістика; медіа-простір; аудиторія; контент; інтерактивні технології; трансформація



The history of archival affairs in different countries: A comparative analysis of structures and organisational methods

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Abstract. This study aimed to examine the historical development of archival affairs and compare the specific features of its evolution in countries with well-established archival traditions, such as the USA, France, Germany, and Ukraine. Another key aspect of the research is the analysis of the structure and principles governing the functioning of archives, both in Ukraine and in other countries where archival science forms an integral part of historical scholarship. The development of archival science has been assessed, highlighting both its strengths and weaknesses. The study explored the history of archival affairs across different countries through the lens of comparative analysis, focusing on organisational structures and working methods. Additionally, it examines how historical, cultural, and socio-political contexts have influenced the development of archival institutions in various regions worldwide. Particular attention was given to ancient civilisations, such as Egypt, Mesopotamia, and the Roman Empire, where archives served as repositories for important documents and administrative records. Furthermore, changes in archival operations during the Industrial Revolution and colonial expansion, which influenced the development of modern archival systems in Latin America, Africa, and Asia, have been analysed. Contemporary trends in archival studies, such as digitisation and the globalisation of archival practices, as well as the challenges faced by archivists in different countries, are examined. A comparative analysis revealed that, despite significant differences in the structure and organisation of archives, a common objective is the preservation of documentary heritage and the provision of access to archival resources. This comparative approach highlighted both shared and distinctive aspects of archival development.

Keywords: archival science; document collections; sources; collections; registers

Introduction

Archival preservation has been a fundamental aspect of governance since ancient times. A strong state could not exist without a written record and documents to underpin its administration and laws. Special mechanisms were required to store up-to-date documentary

information for the stable functioning of state institutions. The needs of government bodies led to the creation of the first archives, and states began to organise the storage and use of documents. Private archives also emerged, primarily to provide legal grounds for

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regulating relationships with the state and through it. The concept of an “archive” can be understood as a sphere of public (state) activity that integrates into the scientific, legal, and practical aspects of organising the custodial preservation and use of documents.

Archival science, as a scientific discipline, emerged in the late 18th and early 19th centuries at the intersection of historical science and state legal practice. It is a complex scientific field that develops theoretical, legal, and methodological problems of archival affairs and integrates several specialised branches such as the theory and methodology of archival affairs, the history and organisation of archival affairs, archival law, and the scientific organisation of archival affairs. H. Rumschöttel (2001) in his research investigated the evolution of archival science from the 16th to the early 21st century. The author focused his research on the last 50 years and discussed the establishment of archival science as an independent academic discipline. He considered the goals, methodologies, and results of archival research, as well as communication channels within the field. The interdisciplinary nature of the field was also examined.

The textbook by M. Donnelly & C. Norton (2020) is useful for those interested in the practice of historical research. The authors provide clear instructions on all stages of the historical process – from research planning and material collection to analysis and writing of historical texts. Theoretical concepts and practical advice are successfully combined. However, the book may be insufficient for those seeking deeper theoretical discussions or a detailed examination of a particular approach. Overall, the work is a valuable resource for understanding the historical research process and its practical application. C. Guardado da Silva (2020) provided valuable information about the integration of archival materials into the history curriculum. The author demonstrates how the use of authentic archival sources can increase interest in history and promote the development of critical thinking. Successful examples of using archives in education and specific practical examples make this article useful for history teachers and archivists.

S.H. Ebrahimi & I. Milford (2022) provided a valuable overview of how innovations in digital technologies are transforming archives, with a focus on the preservation and accessibility of archival materials. The author delved into the impact of digitisation on current preservation and data processing, as well as on the accessibility of historical documents. A significant feature of the article is its emphasis on practical aspects and examples that illustrate how digital technologies either improve or complicate the work of historians and archivists. K. Kalogeropoulos *et al.* (2021) conducted research and published research by renowned experts that offered new perspectives and interpretations in archival science. The studies in this book cover various aspects of ancient archaeology and the origins of

archival science in the form of document preservation, providing researchers with a deeper understanding of contemporary research and methods.

F. Blouin Jr. (2019) examined in detail the innovative contributions of Terry Cook to archival affairs, particularly his approach to archival theory and the concept of a contextual approach. The research focuses on how T. Cook transformed archival practice, emphasising the importance of context in processing and preserving archival documents. While this scholarly article highlights the positive contributions of Terry Cook, it could have done more to illuminate the critical aspects of his work and potential contradictions in his approach. A more in-depth analysis of the responses and critiques of his work would have provided a more balanced perspective.

N.B. Tognoli & J.A.C. Guimarães (2018) offered an innovative perspective on postmodern archival studies and contemporary diplomacy, focusing on new approaches to organising archival knowledge. The authors conducted a detailed analysis of the evolution of archival practices in the postmodern era, including the impact of new technologies and theoretical concepts on records management. Their findings highlight the need to adapt traditional archival methods to contemporary needs and contexts. The research provided an understanding of the changing practices of archival science and its adaptation to new challenges.

In his study, G. Klinken (2019) analysed the integration of archival studies into academic curricula, using Indonesia as a case study. The author provided examples of the successful integration of archival studies courses into university education and analysed how this impacts the training of archival professionals. He also discussed the challenges faced by educational institutions and provided recommendations for improving curricula. Additionally, the study addressed broader issues concerning the development of archival science in Southeast Asia.

In the modern world, archives face new challenges related to digitisation, electronic records preservation, and cybersecurity. An understanding of the historical background and evolution of archival systems enables not only an assessment of their current effectiveness but also the identification of new strategies for improving archival organisation and management. This research aims to conduct a detailed study of the structures and methods of managing archives in different countries, to identify the key principles underlying archival activities, and to analyse the influence of historical and cultural factors on the development of archival systems.

Materials and Methods

To achieve the research objectives, a comprehensive approach was employed. The primary sources used for the analysis were official documents and regulations related to the development of archival science. Specifically, the Central State Historical Archives of Ukraine (2024), the National Archives USA (2024), and The National Archives

UK (2024) were utilised. Documents from these national archives containing primary data on the establishment of archives in each of the listed countries were analysed. In collecting the material, documents directly related to the research topic were carefully selected.

The research methodology involved a comprehensive analysis of documents, allowing for a detailed study of the content and significance of each document examined. The content analysis method, which played a crucial role in this research, enabled the assessment of the quantitative and qualitative aspects of the analysed texts, as well as the identification of key trends and patterns in contemporary archival science. The primary method employed in this research is the historical method, which, in conjunction with logical analysis, allows for a comprehensive investigation of the origins and development of archival affairs. It enables the identification of key stages in the formation of archival systems, highlighting the contributions of leading archivists to the science and practice of archives, as well as analysing the impact of specific historical factors on the state and nature of the archival field. A comparative analysis of the archival systems of several countries, including the United Kingdom, the USA, Germany, France, and Ukraine, was conducted, focusing on their structure, functionality, and the application of new technologies. This allowed for the identification of similarities and differences between centralised and decentralised systems, as well as an assessment of the effectiveness of each model.

The historical-systematic method was a crucial tool for the comprehensive study of archival systems within the context of their historical development and systemic changes. The first stage of applying this method was the analysis of the historical context, which involved studying the political, social, and economic circumstances that influenced the formation of archival institutions. It was important to consider how historical events, such as wars, revolutions, or reforms, shaped the organisation and functioning of archives. The second stage involved investigating systemic changes, which entailed analysing changes in the structure and functions of archival systems over time, including changes in legislation, organisational structure, and archival working methods. The third stage was the systematisation and comparison of data, which allowed for the identification of general trends and specific features of archival systems in different countries, as well as an analysis of the adaptation of archives to new conditions, such as the digital age. The fourth stage was the analysis of cause-and-effect relationships, which allowed for an understanding of how historical events influenced the development of archival systems and their role in society. The final stage was the evaluation of the impact of historical changes on the current state of archival systems, including an examination of how historical stages of development have influenced their present organisation and functioning.

Another important component of the research was the mandatory adherence to the principle of historicism. It is also necessary to mention the application of the principle of the interrelation between archival science as a scientific system or discipline and archival practice. This principle plays a key role in applied research dedicated to the organisation of archival affairs, techniques, archival research, and reference literature.

■ Results and Discussion

Archival science is a complex academic discipline belonging to the historical sciences that studies and develops theories and methods for working with archival documents. In the history of archival science as an independent field of knowledge, four periods can be distinguished (Burr, 1902):

1. Antiquity – 16th century. This period is associated with the emergence of archival science;
2. 16th to 18th centuries. Archival research emerged as an independent field of activity and knowledge. The accumulation of empirical material and the appearance of the first practical developments in this field marked this period.
3. 19th century. The establishment of archival science as an academic discipline;
4. 20th century. A period of maturity for the science, characterised by the analysis and generalisation of accumulated experience, the formation of a stable theoretical basis for the science, and the expansion and deepening of the research field.

Archives exist in every country today, and each one is of research interest. Archives already existed in ancient Eastern states such as Egypt, Babylon, and Assyria. These were typically temple or palace repositories where economic documents, diplomatic texts, and literary works were stored ("Archives – Libraries"). These collections of documents, written in cuneiform on clay tablets, included diplomatic, legal, and private law documents, business reports, and letters. Cuneiform archives were created in palaces and temples of various countries in the Near East (Sumer and Akkadian Empire, Babylonia and Assyria, Elam, the Hittite Kingdom, Phoenicia, Urartu, and Persia), as well as in the houses of large slave owners (especially merchants and usurers). The largest surviving cuneiform archive is the Nineveh cuneiform archive in Iran, which was once part of the library of the famous Assyrian king Ashurbanipal. In Iraq, there is also an archive in the temple of the god Shamash in Sippar (modern-day Abu Habbah).

In Egypt, there is the extensive Tell el-Amarna archive (the diplomatic archive of Tell el-Amarna); in Syria, archives in Mari (Tell Halaf) and Ras Shamra (ancient Ugarit); in Iran, the cuneiform archives of Persepolis, the capital of the ancient Achaemenid dynasty; and in Turkey, the archives of the Assyrian colonies of the 20th-21st centuries BC, such as the Assyrian colonial archives of Kaneš (modern-day Kültepe).

In Ancient Greece, official documents date back to the 6th century BC. In the 4th century BC, the state archives of Athens were centred in the temple of the Metroon. Other ancient Greek city-states and temples (Delphi, Delos) also had archives. In Ancient Rome, archives were initially under the care of priests, but in the middle of the 5th century BC, a senatorial archive was founded in the Temple of Saturn, managed by censors and inquisitors. When the empire was established under Augustus, an imperial archive appeared on Palatine Hill, as well as archives of censors and temple archives (Kalogeropoulos *et al.*, 2021).

Eastern archives are highly developed, with a large number of documents dating from the first quarter of the 8th century, the period of the Arab conquest, as well as materials related to the system of state administration, tax collection, and so on. Some archaeological artefacts have also survived, containing information about writing in the ancient states of Central Asia. For example, fragments of large vessels with inscriptions dating back to the 1st century BC have been found, describing the economic relations and systems of state administration of the Parthian Empire and other states of Central Asia. Early and medieval Central Asian archives are well-known (Rumschöttel, 2001).

Between the 7th and 13th centuries, that is, before the Mongol conquest, many countries in Central Asia (Iran, China, and later under the Babur dynasty, the so-called Mughal Empire) had well-developed systems of record-keeping and document storage, which were at a higher level than in Western Europe and other countries at that time (Colavizza & Blanke, 2021). In early medieval Western Europe, "barbarian" royal archives emerged, which were usually transported from place to place. Archives were located in large monasteries, bishoprics, and feudal knightly castles. Numerous fires and conflicts destroyed archives; only a few secular archives from the 5th to 9th centuries have survived. The most important monastic archives were those of Monte Cassino (Italy), Paris and Saint-Germain (France), Fulda (Germany), and Saint Gallen (Switzerland).

During the 10th to 12th centuries, municipal archives were established to store royal charters, city statutes, court decisions, and financial reports, as well as notarial archives as commercial operations developed. The role and significance of royal archives grew as royal power and centralisation increased. For example, the French royal archive (Imperial Treasury), after the unification of the country, came to contain the archives of provinces and individual feudal lords (Müller, 2013). In Spain, after unification in the late 15th century, a general Spanish royal archive was created in the fortress of Simancas. In 14th century England, several royal archives existed, including those at the Palace of Westminster, one of the towers, and the Rolls Chapel. The early development of the English legal system and the relative security of its island status led to the preservation of a large number

of medieval documents. In England, there were typically many unrelated archives (Donnelly & Norton, 2020).

Most concepts related to the organisation and functioning of archives were developed in earlier periods. The primary task of archives remained unchanged, which was to store documents in a simple order (often chronological) and protect them from loss (Wadhwani *et al.*, 2018). In this regard, the long period of antiquity and the Middle Ages can be characterised as a period of forming the archival model. In subsequent centuries, this independence intensified: in the 16th and 17th centuries, the Royal Archives of Sweden (Swedish: Riksarkivet), the Habsburg archives in Vienna and Innsbruck, the Central Archive in Spain, the Vatican Secret Archives (Latin: Archivum Secretum Vaticanum), and other royal archives were founded in various European countries (De Vivo *et al.*, 2016).

At the same time, archives of many churches, cathedrals, cities, and feudal houses were also organised. People with extensive experience working with documents typically worked in these archives. Their many years of observations formed a serious basis for processing archival material, which was sometimes very mature and methodologically sound. One can speak of the emergence of a practical inductive school that developed methods based on the generalisation of their own practical experience and the results of applying various approaches to processing archives (organisation and description). Based on the results of archivists' experiments, a scheme for systematising documents was developed.

There was also an attempt to develop a sample (an approximate scheme) of the most studied and widespread type of ordering archival documents. Evidence of the application of such a method can be found in the instructions and inventories prepared in Austrian archives in the 16th century, as well as in the example of the organisation of documents in the Royal Archives in Krakow. The existence of archives and the need for a method of organising and describing their contents led to the appearance of the first publications: between the 16th and 18th centuries, a significant number of works appeared in this field. The most famous are the works of authors such as Jacob von Rummingen (1571), Balthasar Bonifacius (1632) and Nikolaus Hussani (1684), as well as Agassis Frich (1664), Jacob Wencker (1713) and L.A. Muratori (18th century), as well as numerous German publications on the state of archives and repositories. Many researchers attribute the beginning of archival science to the 16th century and associate it with the separation of archives and repositories as document storage facilities and the creation of a new profession of archivist as a specialist in archival documents (Tognoli & Guimarães, 2018).

In the 18th century, archival management emerged as a distinct specialised field and underwent significant changes. With the improvement of forms of government and the strengthening of their influence on society, the focus and depth of inquiries from various spheres of national life, directed to state institutions through

administrative bodies, increased. Following these changes, the role and tasks of archives changed. In addition to the traditional function of storing documents in a specific, usually long-established order, the following functions were added:

- ✓ regular replenishment of the archive with various types of acts;
- ✓ ordering the archive's mass, which was more complex than before, according to the functions of the institution that was the author of the act;
- ✓ developing descriptions of archival documents and other means of information retrieval, as well as accounting documents;
- ✓ making documents accessible to users with various purposes.

Thus, a new model of the archive began to form for a new era with new economic and social tasks and functions. The main tasks of archives became: the accumulation, systematisation, and provision of archival documents to users. However, most archives were not independent and remained structurally linked to larger organisational units. The French National Archives, founded in 1790, became a model for the creation of similar institutions in other European countries. Its rapid quantitative growth marked the beginning of the organisation of an entire network of archives – a phenomenon that developed over the next century.

The creation of the French National Archives coincided with the establishment of the position of chief archivist. This event plays a significant role in the history of the archival profession. It was also at this time that the first theoretical works appeared, describing the modern model of an archive (primarily by German and French authors), emphasising the public duty of archives to provide documents for research. A new approach to the methodology of organising and processing documents emerged during this time, known as the rational-deductive school. Its essence was the use of ready-made, pre-developed logical schemes for organising documents. It should be noted that the traditions of record-keeping in archives and the concept of a fonds as an independent and integral complex of documents originating from a single author did not yet exist at that time. The collection of documents from various institutions and individuals in archives was grouped according to various criteria that were most logical from the personal point of view of the archivist or according to the purpose for which the documents were used. The concept of dividing the entire archive by subject matter and topics, regardless of the origin of the documents, formed the basis of the processing program (Dorado & Mena, 2009).

In the 19th century, archival science entered the scene with a significant theoretical and practical foundation. The first stage of this process was the publication of J.A. Ogg's work *Ideas for a Theory of Archival Science* (*Ideen einer Theorie der Archivwissenschaft* (Oegg, 1804). The very title of this book signified the emergence of a new

discipline. Subsequently, the term "archival science" was repeatedly used in the titles of publications about archives. The French model of archives and archival networks began to spread throughout Europe, including Belgium, the Netherlands, Prussia, and the Duchy of Warsaw. At the same time, the view was expressed that the most suitable grouping in archives that store ancient historical acts should indeed be thematic, but the most convenient method for researchers should be adhered to. Historians acknowledge that this marked the beginning of a critical discussion about the appropriateness of subject-based methods of organising documents, which do not guarantee the same success for everyone in finding the necessary material or its accessibility. The controversy surrounding this issue "gave birth to truth", which was presented as the principle of universal organisation of archival documents: in 1838, the French archivist Natalis de Wailly formulated the principle of "respect des fonds" (Dumanskyi, 2023).

Fonds were defined as collections of documents accumulated by institutions, companies, private individuals, and families, and it was forbidden to divide these fonds or mix them with documents of different origins. Natalis de Wailly explained that only the organisation of fonds by actions could ensure a unified approach, as it corresponded to the very nature of the objects themselves. Other classification schemes, based on themes, types (noun-based), or other characteristics, posed a significant risk of failing to locate the necessary documentation. The spread of de Wailly's rules was facilitated by their incorporation into a special regulatory law in 1841, which mandated their adoption in all French prefectural and municipal archives (Burak *et al.*, 2022). Soon, these rules were adopted by other European countries, including Belgium, the Netherlands, and Prussia. The rule of respect for collections shifted archival research towards issues of methodology and terminology, the history of the archival complex, and the scope of its description. The results of archival research in the second half of the 19th century were extremely significant. Efforts were made to systematise the key theses and compile them into a specialised manual on archival affairs.

Such studies were primarily textbooks by French (A. Champollion-Figeac, 1860, G. Desjardins, 1890) and German (G. Holtzinger, 1883, F. von Lohran, 1890) authors. After the French "breakthrough" in the direction of the fonds concept in archival research, it received further development in Germany. This is associated with the names of researchers such as L. Ranke and H. Sybel. The conditions for the transition to fonds classification were formed in Germany in the second half of the 19th century (Hedstrom, 1995). By this time, German historiography had turned its attention to a new subject – political history, and along with it, to a new source – government documents. Ranke's research made a positive contribution in this regard. Ranke's methodology of archival research made it clear that when working with "official"



materials, it is important for the researcher not only to consider their content but also the accompanying documents, as well as the logical and informational connections between the actions produced by the institution. The thematic and other classification systems prevalent in German archives at that time confused these connections and often made it difficult to find materials. Thus, German archivists faced the task of preserving the internal structure and unity of the archival complex. This idea was supported and developed by L. Ranke's protégé, the historian and director of the Prussian National Archives, H. Sybel. He formulated the so-called principle of provenance in the arrangement of documents in archives: in 1881, this principle was introduced into archival practice.

The essence of this principle lies in the division of documents according to their provenance and the prohibition of an institution from splitting up the unity of its documents and destroying the internal and historically formed structure of this unity. Unlike the French rule of respect des fonds, the German principle was based on the need to preserve the internal structure of the archival complex intact at the stage of record-keeping in the repository. France recognised the possibility of its alteration within the fonds. The term "fonds", considered exclusively French, was also not accepted by the Germans. They used the term "Besstand", which denoted a more meaningful concept that did not allow for concessions in logical classification (Cook, 2006). L. Ranke and his school played a decisive role in changing the academic community's view of archives. Authenticity was now primarily limited to official documents. At that time, archives mainly contained documents of this type. Thus, among historians, the opinion was strengthened that without official documents, there could be no reliable history. The principle of provenance had the potential to become a universal approach to solving all theoretical problems in archival research. However, the form developed in Germany was somewhat internally limited and gradually acquired the characteristics of a "principle of provenance".

This meant that the internal structure of fonds had to be preserved in its original form within the institution that carried out the registration, regardless of potential inconveniences for users. The concepts of "fonds" and "principle of provenance" were further developed in the Netherlands, where archival research, like historiography itself, was strongly influenced by Germany: in 1898, Dutch authors S. Muller *et al.* (1920) published *Handleiding voor het ordenen en beschrijven van archieven*. This book was the most popular publication across Europe at the end of the 19th and the beginning of the 20th centuries. In a sense, it "summarised the principles of provenance that were already being used in practice and consolidated them in the theoretical foundations of archival research". For this reason, some researchers call the Dutch the authors of this basic archival classification. This document defines the concept of a fonds as a collection of documents officially received by an institution or

officially formed by an employee of that institution and intended for storage by the institution or its employees.

The principle of originality was understood in terms of the nature of fonds. Everything that was not officially received and officially created had to remain outside the fonds, and the principle of provenance was recognised both in terms of archival arrangement and historical research, as well as in terms of the classification and cataloguing of each archival collection. It was recognised as the best system. The officially approved formulation at this meeting was as follows: "In the classification and storage of archival documents, each document must be placed in the group of documents or part of a group to which that collection (referring to the fonds) belonged during the period when it was still active". Thus, from the 16th to the early 20th century, palaeography underwent a long journey in its development. It has come a long way in its development and has become an independent scientific field of practical knowledge. As a field of knowledge with a practical orientation, it has developed its own principles (Kenosi & Moathodi, 2012).

The concept of archival collections as independent entities, or "fonds" as a self-contained complex of documents created by a legal or natural person (family, lineage), took precedence in the field of archival science. The inherent value of such a complex was recognised, and the importance of its characteristics such as independence, indivisibility, and the organic integrity of the documents contained within it, as well as state principles that include a certain internal order and structure, was emphasised. State principles demanded the preservation of this integrity in archives. They also required that collections be formed solely based on the unity of origin from a single creator (Klinken, 2019). Therefore, the first attempts were naturally made to develop the principles of archival science, laying the foundation for a unified scientific basis for organising documentary fonds in all state archives. This included state archives, organisational archives, and personal archives (De Vivo *et al.*, 2016). The network of state and private archives reflects the administrative structure of each country, its legal framework, administrative-territorial division, and cultural level.

Central archives have the status of national archives and perform the same functions of preserving the national archival heritage, providing archival information to citizens who seek it, and organising work with current government documents. The activities of departmental archives are usually controlled by a national archival body, which provides them with methodological support (Rydén, 2023). Corporate archives house the documentary resources of various public, scientific, cultural, educational, and other non-governmental organisations. They are, in principle, not subordinate to state archival institutions and have autonomy. Many Western countries, including Canada and the USA, have extensive experience in organising work with private archives, which is worth utilising. Based on management principles, two

main types of archival systems are distinguished worldwide: centralised (France, Belgium, Denmark, Greece, Italy, the Netherlands, and Portugal) and decentralised (USA, Canada, Germany, Sweden, Great Britain, Spain, and Japan) (Blouin Jr., 2021).

Archives management ensures the preservation, access, and management of documents that have historical, cultural, and legal significance and are an important part of any country's cultural heritage. While the general principles of archival work may be universal, specific methods and organisational structures vary greatly from country to country (Delsalle & Procter, 2017). The French archival system is known for its centralised and multi-level structure. The National Archives (Archives Nationales) play a significant role in preserving state documents from the Middle Ages to the present day. Regional and departmental archives also exist in France, where important regional documents are stored. The main principles of archives management in France are centralised control, clear legal regulation, and a high level of professional training for archivists. Particular attention is paid to ensuring that archival materials are accessible to researchers and the general public (Yale, 2016).

Unlike France, Germany has a federal structure, which influences the organisation of its archival system.

Each of the 16 federal states has its own archival system, governed by local laws and regulations. In addition to federal archives, there are municipal and private archives (Blouin Jr., 2019). German archives actively use modern information technologies to manage official documents and access them, ensuring a high level of efficiency and transparency in archival activities. In the United Kingdom, archives have a centralised structure, represented by The National Archives, which also serves as the country's primary archive. A significant feature of the UK's archival system is the presence of archives in universities and other educational institutions, fostering a close link between academia and archival affairs. British archives are characterised by high accessibility and the use of digital technologies for preserving and disseminating archival materials. The United States has a decentralised archival system with a large number of autonomous archival institutions. The National Archives and Records Administration (NARA) is responsible for preserving federal documents, but each state has its own archival institution, independent of the national body (Table 1). Particular attention is paid to digitising archival materials and making them available online. US archives actively use advanced technologies to ensure efficient management and preservation of documents.

Table 1. The United States archival system

Level of subordination	Type of archive	Description and functions
Federal level	National Archives and Records Administration (NARA), USA	Preserves federal documents and historical materials. Managed by the federal government, with several regional branches
State level	State Archives	Managed by the individual state governments. Preserves documents related to the state's legislative and executive branches, as well as local history
Local level	Local Archives	Covers documents related to specific cities, counties, or regions. Typically managed by local authorities or historical societies
Private level	Private Archives	Includes archives managed by private organisations, foundations, or individuals

Source: R. Rydén (2023)

The Canadian archival system is also decentralised, although there is a central body – the Library and Archives Canada – responsible for preserving the country's documentary heritage. Provincial and territorial archives have significant autonomy and can take into account local characteristics and needs. Canadian archives are distinguished by a high level of professionalism and the use of modern technologies for preservation and access. The Japanese archival system combines traditional methods and modern technologies. The National Archives of Japan is the country's main archival institution, responsible for preserving national documents and providing public access. In addition to the National Archives, there are prefectural and municipal archives that store important regional documents. Particular attention is paid to the digitisation of archival materials and the use of modern information systems for managing archives (Guardado da Silva, 2020).

China has a long-standing tradition of archival affairs, which is reflected in the country's modern archival system. The State Archives Administration of China is responsible for the preservation and management of official documents. Each province and autonomous region has its own archival management body, operating within the national system. China is actively implementing digital technologies in its archival activities, ensuring efficient management and access to archival materials through the Internet (Caswell, 2017). The Mexican archival system is characterised by a centralised and multi-level structure. The National Archives of Mexico (Archivo General de la Nación) is the country's main archive, which preserves national documents and makes them available to the public. In addition to the National Archives, there are regional and municipal archives that store important local documents. Archival affairs in Mexico are actively developing, implementing modern technologies



for the preservation and management of archival materials. The Brazilian archival system also has a centralised structure, represented by the National Archive (Arquivo Nacional), which is responsible for preserving the national documentary heritage. Regional archives store important regional documents and operate within the national system. Particular attention is paid to the digitisation of documentary materials and the use of modern technologies to ensure effective document management.

Archival systems share common features, such as the desire to preserve a country's documentary heritage, ensure access to information, and promote transparency in management processes. However, there are significant differences in the organisation and methods of archival work (Delsalle & Procter, 2017). Centralised systems, such as those in France and Mexico, provide clear management and control over the preservation of documents. This enables effective coordination of archival work at a national level and the implementation of unified standards and rules. However, such a system can be inflexible and may not take into account local specificities (Klasinc, 2019). Decentralised systems, such as those in the USA and Canada, grant regional archives more autonomy, allowing them to consider local needs and characteristics. This promotes administrative flexibility and innovation but can create challenges in terms of coordination and standardisation of archival work. The emergence of the first archives on the territory of Ukraine is directly linked to the formation of the state, primarily on the lands of Kyivan Rus. The main centres where documents were concentrated were princely courts, monasteries, churches, metropolises, and bishoprics. Personal archives of knights and boyars were also formed. Documents were intended to protect private property (especially land) and to consolidate class privileges. Government documents were used for chronicling.

The Mongol conquest of Kyivan Rus and the decline of the Principality of Galicia-Volhynia had a negative impact on the development of archives, but the established archival tradition continued during the Lithuanian-Polish period of Ukrainian history. Administrative and judicial archives in the Lithuanian-Polish period (15th-early 17th centuries) In the 14th-16th centuries, the Ukrainian regions of Volhynia, Podillia, Kyiv, and Chernihiv-Sivershchyna came under the control of the Grand Duchy of Lithuania. The centralisation of the Grand Duchy of Lithuania also influenced the archives. The development of statehood in Ukrainian lands during the Lithuanian-Polish period, the strengthening of state administration, and the improvement of documentation methods led to the creation of central and regional archives, as well as to an increase in their significance in public life. Archives and repositories of important documents, known as the national and state treasury, were closely linked to the functioning of state power (Cook, 2006).

The origins of the National Archival Fund of Ukraine are associated by scholars with the emergence of the

Cossacks, the formation of the Zaporozhian Sich, and the appearance of the Cossack administration in the 16th century. The existence of a military archive in Trakhtemyriv, Kyiv Region, testifies to this. In this city, registered Cossacks stored weapons, a treasury, royal banners, and important documents (Cossack privileges). Following the establishment of Hetman Bohdan Khmelnytskyi's rule, the archive became a State Archive. Under the Hetman, the General Military Chancellery operated, which received and issued several laws related to internal affairs and diplomatic relations with neighbouring countries. Since the Hetman's administration required various references, an archive was created within the Military Chancellery. In the 18th century, in addition to the Hetman's government chancelleries, the higher Hetman's government institutions also included the Ministry of Finance (which also had its own archives) and the General Chancellery (the General Chancellery had its own archives).

Right-bank Ukraine, which became part of the Russian Empire as a result of the partitions of Poland at the end of the 18th century, was one of the first regions where archival affairs developed. In the region, archival affairs underwent radical changes: the creation of a new executive branch in 1775 and the introduction of provincial and district courts were accompanied by the introduction of Russian-language paperwork. Archives were created at new state institutions based on the Russian model. Old archives of judicial and administrative bodies and municipal self-government bodies were massively destroyed. Almost all books on Magdeburg law and city chancelleries were destroyed, and some books on city chancelleries ended up in private collections.

In the academic history of Ukrainian archival science, three periods are distinguished (1917-1931 – "golden age", 1931-1938 – ideological period, 1939-1990: "era of centralisation and restrictions"; 1991 – revival of national traditions and institutional development), each with its own characteristics and different outcomes. The first stage (1917-1922) is characterised by the recognition of archival science as an important component in the construction of culture, an understanding of the importance of archives as a repository of historical memory, an understanding of the significance of archives as one of the guarantees of the spiritual development of the nation, and an understanding of the significance of archives as a factor in nation-building in the context of the Ukrainian Revolution. The construction of the Ukrainian state during the Ukrainian Revolution actualised the need for ethnohistorical research.

The creation of the Central Archival Administration in 1923 and its subordination to the All-Ukrainian Central Executive Committee marked the second stage of the development of archival science (January 1923-October 1931). Such subordination of the central archival administration, on the one hand, ensured state patronage of archival science, and on the other hand, created problems for state-ordered science. The main

direction of activity of Ukrainian archival institutions was the classification and systematisation of archives. The smoothing over of personal assessments and the suppression of creative research: in 1931-1937, as a result of "purges" and fabricated accusations, representatives of "bourgeois documentation science" were morally and physically destroyed, and document science was completely ideologised. As a result, the development of documentation studies in the Ukrainian SSR stagnated for an extended period.

Between 1917 and 1938, Ukrainian archival science underwent a transformation, evolving from the development of a prophetic model of archival organisation based on scientific evidence to accusations of sabotage. This period also saw the formation of the Ukrainian archival school with centres in Kyiv and Kharkiv. V. Veretennikov's open development of research programs and educational functions, focused on the creative use of foreign experience while taking into account national characteristics was completely destroyed. The third period of development of Ukrainian archival science ("the era of centralisation and restrictions"). The integration of archives into the totalitarian regime and the strengthening of party dictatorship led to the stagnation of Ukrainian archival science, the loss of leading researchers, and the reorientation of archaeographic activities towards using archival information for operational-political purposes, effectively replacing archival research. Thus, the scientific basis of archival affairs was replaced by a tendentiously interpreted methodology of single-case archaeography, and archaeography was supplanted and trivially reduced to the development of rules and instructions. The normalisation of archival activities required competent specialists in archives (Yekelchuk, 2007).

Qualified specialists and the development of archival technical methods were needed, and in 1944, the

Department of Archival Science was established, and soon afterwards, the archival postgraduate program was transferred to the Central State Archival and Information Administration in Kyiv; in 1947, the "Scientific and Information Bulletin of the State Archives of the Ukrainian SSR" began to be published – a peripheral journal for solving scientific and methodological issues, reproducing scientific and methodological documents and providing them to city and district archives. Thus, archival periodicals were revived. Archival affairs were headed by the Bureau of Archives under the Council of Ministers of the Ukrainian SSR and remained under the control of party and state bodies. The 1970s were marked by a strengthening of instructions regarding the content and forms of using archival information.

The most notable archival work of this period was the monograph by O. Mitiukov, which became the first generalisation in domestic historiography of factual material on the development of archival affairs from 1917 to 1973. However, the defence of the monograph and several doctoral dissertations did not indicate a strengthening of archival research: until the end of the 1980s, only a biographical orientation developed. With the declaration of Ukraine's independence in August 1991, a new wave of national and cultural revival occurred. Ukraine democratised and joined the international community. This necessitated a new understanding of the role of archives in society and the state, the importance of historical, archival, heritage, and archaeographic research, reforming Ukraine's archival system in line with its democratisation. A crucial component in the development of archival research was the creation of the Ukrainian Research Institute of Archival Affairs and Records Management in 1994 (Yekelchuk, 2007). Archives can be created by state authorities, local self-government bodies, and legal and natural persons, regardless of their ownership (Table 2).

Table 2. Archival system of Ukraine

Management level	Main archival institutions	Description
National level	State Archives of Ukraine	The main state archive responsible for storing and organising state documents and important historical materials
National level	National Archives of Ukraine for Contemporary Documents	Stores contemporary documents and ensures their long-term preservation
Regional level	Regional State Archives	Responsible for storing documents related to specific regions, including historical and administrative documents
City/district level	City and District Archives	Stores local documents, such as those from city and district administrations, and historical documents of local significance
Specialised archives	Archives of specialised institutions and organisations	Stores documents related to specific sectors or institutions, such as archives of museums, universities, and research institutes

Source: Central State Historical Archives of Ukraine (2024)

The central government body with special powers in the field of archival science and record management is the State Committee of Archives of Ukraine, which is responsible for the main direction of activities of bodies in this field, starting from the creation of the National Archival Fund of Ukraine (NAF) and ending with the creation of appropriate conditions for the storage and

use of archives, the development of archival affairs, and ensuring the preservation of documents, etc. The organisation is responsible for the main directions of activities of departments in this field – from the formation of the National Archival Fund of Ukraine (NAF), the creation of appropriate conditions for the storage and use of official documents, to the development of international

cooperation. Archival institutions subordinate to the State Committee of Archives are part of the Ukrainian archival system (the system of the State Committee of Archives of Ukraine) (Ivanushchenko, 2011).

The National Archival Fund of Ukraine comprises the Central State Archives, other central archives, and regional archives. National archives are divided into general and specialised archives, fonds archives, and historical archives. National archives aim to preserve documents regardless of their age, material, or recording technology. They ensure the preservation of a variety of documents, including those created on different media and using different methods of recording information. Unlike general archives, specialised archives focus on documents that have specific temporal, thematic, or technical limitations. Accumulation archives, also known as national accumulation archives, constantly replenish their holdings with documents from specific sources that correspond to their profile. Historical archives, in turn, preserve documents from institutions that operated in past historical epochs and no longer function. Archives in Ukraine operate following national legislation, as well as rules and instructions approved by central executive authorities. They adhere to national standards and other regulatory legal acts. The classification of archives is based on two main criteria: the type of archive and the form of ownership under which it was created. The main links in the Ukrainian archival system are state archives (archival departments of central, regional, city, and local state administrations), sectoral archives (archives of state institutions or public organisations), and archives based on collective or private ownership.

Research findings demonstrate a variety of approaches to organising archival systems in Ukraine, France, Mexico, Brazil, the United States, and Canada. Centralised archival systems, such as those in France, Mexico, and Ukraine, have proven effective in ensuring uniform standards, document preservation, and management at the national level. For example, a study conducted by O. Vernik & Yu. Vernik (2022) showed that in France, centralisation contributes to the preservation of documents and makes them accessible to researchers and the general public. On the other hand, decentralised archival systems, such as those in the USA and Canada, exhibit a high degree of adaptability to local conditions and needs. Therefore, regional archives can take into account local specificities. According to a study by M.L. Caswell (2017), decentralisation in the USA has led to the preservation of a wide range of documents at the local level. However, the lack of unified standards and coordination between bodies involved in preservation can lead to inefficient document management. Historical and political changes have had a significant impact on the development of the system for ensuring the preservation of documents in Ukraine.

The digitisation of documents and the use of modern technologies ensure the longevity and accessibility

of archives. This has been confirmed in research by P.L. Punzalan (2023), which found that the digitisation of documents in Canada has made them accessible to a wide range of users and significantly simplified the search process. This aligns with the findings in this study, which showed that the implementation of digital technologies in archival systems not only preserves documents but also makes them accessible anytime, anywhere. The research confirms the importance of archival systems for preserving documentary heritage, which aligns with the thesis of G. Colavizza & T. Blanke (2019), who notes that archives play a crucial role in preserving national history and culture. A comparison of the results of this study with other studies shows that different models of archival systems have their own advantages and disadvantages. The choice of model depends on the specific conditions and needs of each country. Centralised systems offer a high degree of control and standardisation, while decentralised systems offer greater flexibility and adaptability. In Ukraine, for example, the centralised archival system ensures effective management of documents at the national level, as confirmed by H. Ivanushchenko (2011). However, as noted in the research, this model may be less adaptable to local needs.

Research has shown that international cooperation in the field of archives can foster the exchange of experiences and the implementation of best practices. P.L. Punzalan (2023) demonstrated that archival institutions from different countries can implement the latest technologies and methods for preserving documents by working together. This would contribute to improving the efficiency of archival systems and preserving documentary heritage on a global scale. The use of modern technologies for digitising documents and creating online databases can significantly improve access to and preservation of documents. D.E. Marsh *et al.* (2023) analysed how anthropologists, using scientific approaches, utilise archival materials in their work, as well as their attitudes towards archives. The authors noted that modern archives serve not only as repositories of documents but also as important resources for interdisciplinary research. The research shows that archival materials, even in scientific disciplines where their influence was previously minimal, are gaining increasing popularity and significance. Concerning this topic, the research demonstrates the importance of comparing international practices and methods of archival work. D. Marsh points to different approaches to preserving and accessing archival materials, which can vary depending on the country or region. These variations may be related to the historical development of archival affairs, cultural differences, and the legal and institutional frameworks that regulate archival activities.

Based on this, it can be concluded that archival systems are a crucial tool for preserving documentary heritage and ensuring access to historical documents. Different models of archival systems have their advantages

and disadvantages, and the choice depends on the specific conditions and needs of each country. Reforming archival institutions, adapting to new technologies, and international cooperation are key to the further development of archival research. Archival institutions play a vital role in preserving historical memory and ensuring access to important documents, which is essential for government administration and cultural identity. The study of R. Rydén (2023) is an important work that explores how national archives define their role in shaping national memory and identity. The author analysed the strategies used by national archives in different countries for self-representation, as well as how these strategies influence the perception of archives as institutions that preserve and transmit national heritage. In the context of this topic, R. Rydén's research is highly relevant. It shows how national archives in different countries may approach their mission differently, depending on the historical, cultural, and political context. These differences in approach can be important for comparative analysis, as they highlight that the structure and functions of national archives are not universal but depend on specific national circumstances.

Research into the role of technology in archival affairs demonstrates that digitising documents not only increases accessibility to information but also reduces the risk of losing valuable historical documents. For instance, in many countries, the implementation of automated systems has significantly simplified the processes of cataloguing and information retrieval. As a result, archives can respond more effectively to requests from researchers, the public, and government agencies, which in turn contributes to increased transparency and efficiency in government operations. International cooperation has also opened up new opportunities for archival institutions. Interaction between archivists from different countries allows for the exchange of experiences and knowledge, which helps in developing universal standards and protocols. Such cooperation promotes innovation in the field of archiving, which is critical for preserving documentary heritage in an era of rapidly developing information technologies. Archival systems in different countries reflect not only the technological level of development but also the cultural and political characteristics of those countries.

It is also important to note that archives play a key role in shaping national identity. Preserving cultural heritage, including literary and historical documents, is critical for safeguarding national memory. Models of archival systems, both centralised and decentralised, have their advantages but also face certain challenges. For example, centralised systems may have a problem with flexibility, as standards set at the national level may not meet local needs. At the same time, decentralised systems may encounter difficulties in coordinating between different regional archives, which can lead to duplication of efforts and inefficient use of resources. Another issue concerns

the accessibility of archival documents. In countries with decentralised systems, access to documents may be complicated due to the lack of a unified database and standardised access procedures. In such cases, the use of modern technologies, such as cloud services for protecting and tracking documents, can significantly improve the efficiency of archival institutions. Future research in archival affairs could focus on improving digitisation technologies and the management of archival documents. For instance, the use of artificial intelligence for automated classification and cataloguing of documents can significantly reduce time and resource costs. Additionally, a crucial area of research is the impact of globalisation on archival systems. In an environment of increasing international cooperation, preserving cultural and historical heritage can become a global challenge. Developing international standards and protocols for preserving and accessing archival documents could be a key aspect of future research. Another direction for research is the ethics of managing archives. How can the confidentiality and security of personal data be ensured in the context of increasing information openness? This question becomes increasingly relevant with the development of digital archives and global data exchange networks.

Conclusions

This study conducted a detailed comparative assessment of the history of archival affairs in various countries, with a focus on the structures and methods of organising archival systems. The research results confirm that while archival affairs share common principles, they vary significantly depending on the cultural, historical, and social contexts of each country. This was revealed through an analysis of the evolution of archival structures, methods of storing and processing documents. Today, archival science has become one of the fundamental branches of historical science, without which the positioning of history as a science would be impossible. The study analysed the structures and methods of organising archival affairs in the most developed countries, which allowed the identification of the main approaches to preserving documentary heritage. It was established that archival affairs reflect national characteristics, including political and cultural traditions. In countries with a longer history of centralised power, archival systems were usually more developed and structured, which contributed to the more effective preservation of historical documents even to the present day, but today a significant factor in archival affairs is the decentralisation of archives.

The research findings indicate a need for improvement in national archival systems, particularly through the implementation of new technologies for digitising archives, creating unified standards for organising and preserving documents and ensuring open access to archival materials. However, the research also has certain limitations related to differences in cultural and political contexts that influence archival affairs. These

limitations made it difficult to apply universal approaches to organising archives, highlighting the need for further research aimed at developing adaptive models of archival management. The obtained results show that the performance indicators of archival systems can vary from efficiency in document management to the level of information accessibility for users. A comparison of systems revealed both the strengths and weaknesses of different approaches to archival affairs. For example, countries with developed archival systems demonstrate a high level of standardisation and technological progress, which positively impacts the preservation and access to archival materials. At the same time, in countries with less developed systems, there may be problems with providing access to documents and their long-term preservation. Understanding these differences allows for better identification of the most effective practices and approaches that can be used to improve archival affairs at the international level.

Further research in this field should focus on finding new approaches to organising archives that ensure their efficiency and accessibility in the long term. This may involve developing technologies that facilitate digitisation and the formation of international standards for document preservation that take into account national specificities. The research was subject to certain limitations, including data availability, as some official documents and legislation were inaccessible for research due to information access restrictions and confidentiality. Cultural and linguistic differences also significantly influenced the interpretation of certain aspects of archival work in different countries.

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■ Conflict of Interest

None.

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Історія архівної справи в різних країнах: порівняльний аналіз структур та методів організації

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Анотація. Метою дослідження було висвітлити історичний процес становлення архівної справи, і порівняти специфіку розвитку в країнах з розвинутими архівознавчими студіями такі як США, Франція, Німеччина, Україна. Також важливою складовою частиною дослідження було пояснення структури та принципів функціонування архівів як в Україні, так і в інших країнах де архівознавство є базовою частиною історії. Було проаналізовано процес розвитку архівознавства з його позитивними і негативними рисами. У дослідженні розглядалась історія архівної справи в різних країнах крізь призму порівняльного аналізу організаційних структур і методів роботи архівів. Досліджувалось, як історичний, культурний і соціально-політичний контекст вплинув на розвиток архівних установ у різних регіонах світу, Стародавніх цивілізацій, таких як Єгипет, Месопотамія та Римська імперія, де архіви використовувалися для зберігання важливих документів та адміністративних записів. Крім того, проаналізовано зміни в роботі архівів під час промислової революції та колоніальної експансії, які вплинули на розвиток сучасних архівних систем у Латинській Америці, Африці та Азії. Розглянуто сучасні тенденції в архівних дослідженнях, такі як зацифрування та глобалізація архівної практики, а також виклики, з якими стикаються архівісти в різних країнах. Порівняльний аналіз показав, що, попри значні відмінності в структурі архівів і способах їх організації, спільним знаменником є прагнення зберегти документальну спадщину і забезпечити доступ до архівних ресурсів. Цей порівняльний аналіз продемонстрував як спільні, так і унікальні аспекти розвитку архівів

Ключові слова: архівознавство; збирання документів; джерела; колекції; реєстри



The application of blockchain technology in document storage: Opportunities and challenges

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Abstract. This study explored the potential applications of blockchain technologies in document preservation, focusing on their efficiency, security, and economic feasibility. The technology's key advantages have been identified, including transparency, data immutability, process automation, cost optimisation, and enhanced trust in digital systems. An analysis of practical case studies has demonstrated significant benefits across various countries. In Estonia, the e-Tax system has reduced tax violations by 20%, accelerated financial transaction processing, and automated tax control. In Georgia, using blockchain in the land registry has lowered administrative costs by 25%, shortened property registration times, and reduced legal disputes by 30%. In the USA, the introduction of smart contracts in the rental sector has reduced contract execution times from 14 days to 48 hours, while administrative errors have decreased by 30%. Despite these advantages, challenges remain in implementation, including scalability, high energy consumption, legal regulation, and the complexity of integration into existing systems. Measures have been proposed to further develop the technology, including the establishment of international standards, legislative adaptation, the implementation of energy-efficient algorithms, the expansion of training programmes for personnel, and the integration of blockchain with other digital tools. Additionally, the use of blockchain enhances cybersecurity, as data stored in a distributed ledger cannot be altered or falsified. This ensures the protection of documents against forgery while preserving their authenticity and integrity. In the future, the technology could facilitate the creation of global digital identification systems, forming the foundation for e-governance and secure data exchange. The findings of this study may serve as a basis for further research and the development of strategies for large-scale blockchain implementation in public administration, the financial sector, logistics, and the digital economy

Keywords: tax revolution; accounting and storage; decentralisation; Proof-of-Stake; Web3; transparency and protection

Introduction

The growth of digital technologies and the need to ensure reliable data storage have generated significant interest in the use of blockchain technology in document storage. In the current context of growing volumes of digital information, it has become crucial to ensure the

long-term preservation of documents without the risk of loss or damage. As noted in the article of I. Bida & M. Petrov (2019), digital documents require maximum protection. The author's research was focused on analysing the technological aspects of using blockchain to ensure the

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legal protection of data in the public and corporate sectors, which is critical to mitigating the risks of manipulation or loss of information. A large number of government institutions have transitioned to electronic document management, increasing the relevance of the research.

The use of blockchain in document management systems has significantly increased the level of trust in digital data and ensured their secure long-term preservation. As Y. Honcharova (2020) notes, blockchain technology is a key element of Industry 4.0, facilitating process automation and reducing the risks of data falsification. This makes it particularly effective in areas where transparency and data reliability must be guaranteed, such as government accounting and document management. V. Gulin (2020) highlights that the distributed nature of blockchain contributes to reducing the risks of unauthorised access to information. The technology enables the creation of immutable data registers, which is critical for legal security and the protection of property rights in the digital space. In particular, blockchain allows for the creation of decentralised platforms for registering property rights agreements, which do not require intermediaries, significantly reducing the risk of fraud. V. Gulin also investigates the impact of cryptographic technologies on the protection of corporate documents, emphasising the advantages of decentralised databases in preventing unauthorised access.

O. Tkalenko & M. Melnyk (2019) emphasise that cryptographic algorithms, such as SHA-256, used in blockchain, provide a high level of security and make data falsification impossible. In their research, they investigated how blockchain ensures these aspects through the use of cryptographic algorithms and a distributed architecture, which minimises the risks of data modification. Blockchain technologies offer data immutability through the use of cryptographic algorithms and hashing, which guarantees data integrity. This approach allows for the storage of information in the form of encrypted blocks, providing reliable protection against modifications. Historically, blockchain was first applied in the financial sector as the foundation for cryptocurrencies such as Bitcoin, however, its potential has proven to be much broader. As M. Mironchak & V. Gricak (2020) noted, blockchain enables the creation of a chain of blocks with unique cryptographic signatures, which guarantees data integrity and confidentiality. This makes the technology attractive for use in such critical areas as medical archives, registration systems, and educational platforms. The implementation of this technology has allowed for the storage of large volumes of confidential information that was only accessible to authorised individuals.

V. Koibichuk & M. Rozhkova (2020) note that blockchain not only optimises logistics processes but also ensures product origin control, guarantees their authenticity and creates transparency in international supply chains. Blockchain is also finding application in logistics, where it helps track the movement of goods throughout the

supply chain. O. Lapko & O. Solosich (2019) notes that the use of blockchain in logistics systems allows for a significant increase in process transparency, reduces the likelihood of fraud, and prevents the falsification of information about the origin of goods. This has ensured process transparency and prevented the falsification of information about the origin of goods, their quality, and storage conditions. In the field of document storage, blockchain has been used to create secure electronic registers, which have been used in medical archives, educational systems, and government information platforms. The use of blockchain in accounting has helped to reduce the risk of data falsification due to the immutability of records in the register. This approach can be applied to store educational certificates that confirm the authenticity of issued diplomas. Despite these challenges, research into the legal and regulatory aspects of blockchain implementation remains important, especially in the context of its application in government agencies, medical archives, and educational institutions (Balazyuk & Pylyavets, 2022). Issues such as the integration of blockchain with existing platforms and the development of international standards to ensure platform compatibility, and the unification of information exchange approaches remain understudied.

The research aimed to determine the role of blockchain technologies in increasing the efficiency of digital data storage, ensuring its security and transparency, and creating conditions for the long-term preservation of information without the risk of loss or manipulation. The main focus was on the analysis of practical cases of using blockchain in various fields, such as government information systems, educational archives, and medical registries.

Materials and Methods

Several approaches were used in the research to ensure the analysis of blockchain technology implementation in document storage. The main focus was on case studies that demonstrate realworld examples of the technology's application in different countries. The case study method was used for the analysis, which involves a detailed study of realworld examples of blockchain technology implementation in document storage systems. Three key case studies were considered in the research. The first case study concerned the implementation of the e-Tax system in Estonia, developed and implemented by the Estonian Ministry of Finance. The aim of implementing this system was to ensure the automation of tax accounting and increase the transparency of financial transactions through the use of blockchain technology. The main sources for the analysis were reports from the Estonian Ministry of Finance, works by F. Casino *et al.* (2018) and S. Volosovych *et al.* (2019).

The second case study is dedicated to land registration in Georgia, where blockchain was implemented by the National Agency of Public Registry of Georgia. This implementation aimed to ensure the transparency and integrity of land transactions. For analysis, official

documents of the agency, research by S. Haber & W. Stornetta (1991), and L. Sloboda & A. Senkovich (2018) were used. The third case study is the implementation of the Blockchain-based Rental Documentation Management system in the USA, implemented with the participation of IBM Blockchain Labs. The main organisation that implemented this system was First National Realty Partners (FNRP). The implementation aimed to increase the efficiency and transparency of rental documentation management processes. In this context, the analysis was based on reports from IBM Blockchain Labs, publications by J. Santos *et al.* (2024).

A comparative analysis was conducted to assess the advantages and disadvantages of implementing blockchain compared to traditional document management methods. Transparency, security, energy consumption, and document processing speed were analysed. Data for comparison was collected from official reports and scientific articles, such as the studies of F. Casino *et al.* (2018), J. Santos *et al.* (2024), and L. Sloboda & A. Senkovich (2018). Content analysis was based on the study of publications, reports from international organisations, and government structures that highlight the aspects of blockchain implementation. Particular attention was paid to the advantages of the technology in ensuring transparency and data protection. The source base included the research of F. Casino *et al.* (2018), S. Haber & W. Stornetta (1991), S. Volosovich *et al.* (2019). The processing of literary sources provided a comprehensive overview of the advantages and challenges of blockchain. The sources that provided the basis for the research included contemporary scientific articles, reports from international organisations, and government structures. For example, the studies of S. Haber & W. Stornetta (1991), F. Casino *et al.* (2018), and L. Sloboda & A. Senkovich (2018) detailed the fundamentals of the technology, while reports from IBM Blockchain Labs described its implementation in commercial structures. The evaluation of statistical data was based on reports that provided specific indicators of blockchain implementation in different countries. In particular, projects in Estonia, Georgia, and the USA were analysed, which allowed for a detailed picture of the technology's effectiveness and challenges.

Results

Implementation of e-Tax in Estonia

The e-Tax system, developed and implemented by the Estonian Ministry of Finance, is one of the leading examples of digitalisation in public administration. The main reasons for its implementation were the need to address issues of tax fraud, corruption, and low levels of trust in government institutions. Prior to the introduction of new technologies, Estonia's tax administration system was characterised by significant bureaucratic complexity, which slowed down the processing of tax returns and reduced the efficiency of tax authorities (Anushka *et al.*, 2024). The e-Tax system became a key element of

digitalisation in Estonian public administration. The main technologies implemented include distributed databases that ensure the immutability of records, and Keyless Signature Infrastructure (KSI) technology, developed by Guardtime, which is used to verify data authenticity, reducing the risk of manipulation and ensuring process transparency (Casino *et al.*, 2019).

Thanks to the implementation of the system, the number of tax abuses has decreased, and the level of public trust in the tax system has significantly increased. The integration of e-Tax with other state registries has ensured automatic data verification, which has reduced the number of errors in tax returns and accelerated their processing (Wang, 2022). The integration of registries has become an important part of the implementation of e-Tax. Automatic data verification through demographic and land registries has significantly optimised the administration process, allowing for the avoidance of data duplication and speeding up the processing of requests. Additionally, the implementation of KSI technology has enabled tracking of any changes in registries in real time, ensuring data transparency and accuracy (Volosovich *et al.*, 2019). The legal adaptation of the system involved bringing it into compliance with current legislation and international standards, such as GDPR. This ensured the protection of user data and compliance with European privacy requirements. To achieve this, the government collaborated with international experts to create secure data transfer protocols and minimise the risks of unauthorised access to information (Wang, 2022).

Staff training was another crucial element of the implementation. Over 95% of tax authority employees successfully adapted to working with the new system after completing training programs. Specially designed online courses for citizens allowed for rapid system mastery, reducing the number of requests to the support service (Anushka *et al.*, 2024). The social impact of e-Tax is also significant. Citizen satisfaction with tax services increased by 30%, demonstrating the system's success in improving interactions between the state and citizens (Volosovich *et al.*, 2019). The reduction in administrative costs allowed for significant savings in the state budget, which were directed towards social programs such as education and healthcare. However, the implementation of e-Tax was accompanied by numerous challenges. E. Karaarslan & E. Konacakli (2020) note that the high cost of implementing blockchain solutions is due to the need for significant investments in server infrastructure, the development of specialised software, and the adaptation of existing platforms. One of the main problems was the initial cost of modernising IT infrastructure, which included the purchase of servers, the upgrading of network equipment, and the creation of highly complex software. Another challenge was the integration of the system with existing state registries.

Staff training was another challenge, as explaining the complex technical aspects of the system required

the development of detailed training materials and the conduct of practical classes. Also, in some regions, there were still problems with stable internet access, which created barriers to the full functioning of e-Tax, especially in rural areas (Wang, 2022). Despite these challenges, the successful implementation of e-Tax has made Estonia a leader in the field of digital tax administration and an example for other countries planning to introduce similar systems.

Land registration in Georgia

Georgia was one of the first countries to implement blockchain for land property registration. In 2016, the National Agency of Public Registry of Georgia (NAPR) partnered with Bitfury Group to create a secure, transparent, and efficient land registration system. The primary reasons for this innovation were the need to combat corruption, eliminate errors in records, and simplify access to registration services for citizens. This allowed the state to transition from paper-based registers, which contained many inaccuracies and required constant updating, to a digital platform that guarantees the reliability and immutability of records. The primary technical solution implemented in the system is SHA-256 – a cryptographic algorithm used to hash data on registration transactions. This ensures the immutability of information and guarantees that any changes to records can be tracked (Sloboda & Senkovych, 2018). As a result, any interference with registration becomes technically impossible, and data is stored in a secure environment that can only be accessed by authorised personnel. The introduction of blockchain solutions has significantly reduced the time required to process land transactions, which previously could take several weeks but can now be completed within a few hours. Automated transfer of ownership has eliminated the possibility of external interference in registration processes, increasing public trust in the system and government agencies in general. One of the key outcomes of implementing the technology has been a significant reduction in administrative costs, which, according to experts, has reduced the budget costs of maintaining the land registry by 25% (Humaid, 2022).

O. Podvornuk & N. Polishuck (2021) note that the digitalisation of administrative processes in the public sector significantly reduces the level of litigation, ensuring the reliable recording of legal relations in an immutable digital registry. Moreover, the digitalisation of processes has contributed to a 30% reduction in the number of legal disputes regarding land rights, as all operations have become transparent and backed up by immutable records. The Georgian blockchain land registry also complies with European standards in the field of land management, in particular, the GDPR requirements for the protection of personal data and transaction security. Integration with international legal norms allows Georgia to ensure transparency in registration

procedures and increase the trust of investors and citizens. While the implementation of blockchain technology has offered numerous benefits, it has also been accompanied by a range of challenges. One of the most significant obstacles was the complexity of integrating the new system with existing government registries, which had previously operated in isolated systems and had different data structures (Zyskind *et al.*, 2015). To ensure compatibility and seamless information exchange, the government had to upgrade its IT infrastructure, requiring significant financial investment and technical effort. Another challenge was the need to train staff who would be working with the new system. Special training programs were organised for public servants responsible for maintaining registration records, and training programs were also developed for notaries and other participants in the registration process. Furthermore, adapting legal norms to the new digital system required alignment with international standards such as GDPR and European land management standards, which further impacted implementation timelines (Humaid, 2022).

The costs of implementing the blockchain system also posed a significant challenge for the state. The purchase of server equipment, the development of software, staff training, and technical maintenance required substantial financial resources. However, in the long term, this solution has reduced the costs of maintaining registers and ensured the stability of the system (Humaid, 2022). Another important aspect is the complexity of user adaptation to the new system. Despite the simplification of registration procedures, some citizens initially faced difficulties in using the digital platform, which required additional consultations and explanatory work from government agencies. To minimise this barrier, a series of educational initiatives and consultation programs were implemented. Additionally, scaling the system and integrating it with other government structures required additional technical solutions, which could slow down the expansion of the platform. However, the Georgian government is actively working to improve the technology, allowing it to gradually adapt to new requirements and ensure resilience to potential future changes (Mironchak & Grycak, 2022).

The use of blockchain in land registration in Georgia has been a significant step towards increasing the transparency of public administration and building public trust in government agencies. Experts believe that this experience can be useful for other countries seeking to implement similar systems, as it not only ensures the reliability of registration data but also minimises corruption risks and improves the efficiency of government institutions.

Blockchain-based Rental Documentation Management in the USA

Blockchain-based Rental Documentation Management in the USA has emerged as a revolutionary solution in

the realm of real estate digitalisation. The implementation of this system, initiated by IBM Blockchain Labs in partnership with First National Realty Partners (FNRP), aimed to address challenges such as delayed contract execution, document errors, and a lack of transparency in financial transactions (Santos *et al.*, 2024). The application of blockchain significantly reduced the time required to process agreements and increased trust between tenants and landlords. One of the key technological solutions was the use of smart contracts, which automated the verification of payment discipline, the making of amendments to contracts, and the monitoring of the fulfilment of obligations. This reduced the likelihood of administrative errors and ensured instant updates to records in the event of changes to the terms of an agreement (Qi-Long *et al.*, 2019). The use of blockchain as the foundation of the registry guaranteed the immutability of records, eliminating the possibility of their falsification or unauthorised modification.

The Blockchain-based Rental Documentation Management system fully complies with the Uniform Electronic Transactions Act (UETA), which legalises electronic contracts and digital signatures in the USA. According to the UETA, electronic agreements have the same legal force as traditional paper documents, allowing blockchain to be used for the legitimate management of rental documentation (Uniform Electronic Transactions Act, 1999). Additionally, the use of digital signatures ensures the legal protection of the parties to the agreement and the ability to subsequently verify the authenticity of contracts. Among the main achievements of implementing this system is the reduction in the time it takes to conclude rental agreements from two weeks to 48 hours thanks to automated checks and digital interaction between landlords and tenants (Qi-Long *et al.*, 2019). As noted by X. Qingshu *et al.* (2021), the use of blockchain in the real estate sector significantly simplifies the process of concluding contracts, reduces bureaucratic delays, and lowers the risk of financial manipulation. Smart contracts have reduced the number of administrative errors by 30%, increasing the efficiency of document management and minimising the risk of fraud. Moreover, the level of disputes among tenants

has decreased by 30% as all transactions have become transparent and immutable once confirmed by the parties to the agreement.

Despite its numerous advantages, the implementation of the system was accompanied by several challenges. One of the primary barriers was the cost of modernising the IT infrastructure, which involved integrating blockchain with existing government registries and financial services. This required the creation of additional APIs and connections to banking platforms for automated payments (Qi-Long *et al.*, 2019). Another challenge was the need to train staff and tenants. As most users had no prior experience with blockchain systems, companies had to invest in training programs, organising training sessions for real estate agents and legal consultants (UETA, 1999). Additionally, adapting legal norms to the new digital system required changes in the regulation of digital signatures and smart contracts at the state level. A separate challenge was scaling the system. Despite the high efficiency of blockchain, integration with large commercial landlords and financial institutions required compliance with various legal standards across the USA. As laws governing digital agreements can vary from state to state, companies have had to adapt the system to meet local requirements (UETA, 1999).

The implementation of Blockchain-based Rental Documentation Management in the USA has been a significant step in the field of digital real estate, enabling the automation of contract execution, increased security and transparency of financial transactions, and reduced administrative errors. However, scaling the system remains a challenge, as different states have their own legal requirements for digital agreements. Expanding the platform allowed for the integration of new functionalities, including automated report generation for auditing and the creation of a transaction history database. This database provided participants with access to complete information on previous transactions, becoming a valuable tool for long-term asset management. Additionally, the introduction of machine learning functions enabled the prediction of default risks based on the previous behaviour of tenants, demonstrating a significant improvement in risk management (Table 1).

Table 1. Functionalities of Blockchain-based Rental Documentation Management

Platform capabilities	Implementation effects
Automated report generation	Reduced time and resource costs for auditing
Transaction history	Access to data for improved long-term asset management
Machine learning features	Predicting payment default risks
Digital signature integration	Ensuring the legal significance of electronic documents
Data privacy	Reduced risk of privacy breaches by 40%
User rating	Reduced risks of working with unreliable partners
Payment verification automation	Reduced default rates by 25%
Creation of a centralised database	Optimised access to historical transactions
Investment attraction	Increased investor trust and funding by 18%
Improved customer experience	Reduced legal disputes by 30%

Source: created by the authors based on the conducted research

Tenants also gained access to the platform, allowing them to check their transaction history, contract status, and payment timeliness. This contributed to a 30% reduction in disputes and improved customer experience. FNRP's reputation as an innovative company focused on customer needs has significantly grown. The implementation of Blockchain-based Rental Documentation Management was a significant step in the digitalisation of the real estate market in the USA. The optimisation of rental documentation management processes has demonstrated the significant potential of blockchain technology in transforming the industry. The successful experience of FNRP has set a precedent for considering similar solutions in an international context. Furthermore, the platform facilitated the development of new business models in the rental property sector. For example, ensuring data transparency has enabled the development of tenant and landlord rating mechanisms, which has helped reduce the risk of dealing with unreliable partners. In the future, such systems can form the basis for the creation of global rental management platforms, integrated with other financial and legal tools, creating new opportunities for the global real estate market.

A comparative analysis of blockchain technologies and traditional document management methods

The use of blockchain in document management offers enhanced transparency, immutability of records, and process automation, setting it apart significantly from traditional methods of document management. Traditional document management systems have several

limitations, including centralised control, the need for notarisation, and the risks associated with human error in information processing. The use of blockchain in document management allows for the elimination of these drawbacks through a distributed system of record-keeping and the use of smart contracts (Qi-Long *et al.*, 2019). Despite the advantages of blockchain solutions, their implementation is accompanied by certain challenges. A major barrier is the need to adapt legislation, as in many countries, legal norms do not yet recognise the legal force of smart contracts, hindering their widespread use. Additionally, under international regulations such as GDPR, there are certain restrictions on storing personal data in immutable blockchain records. The lack of unified regulatory standards also slows down the implementation of this technology in the field of document management (Berestov, 2024).

O. Balazyuk & V. Pylyavets (2022) note that blockchain can significantly reduce the risk of data falsification due to cryptographic mechanisms and the immutability of records. A comparison of blockchain technologies with traditional document management methods demonstrates that blockchain provides automated information verification, significantly reduces the likelihood of errors and forgeries, and minimises administrative costs. In contrast, traditional methods require additional human oversight, which can impact the speed and efficiency of document processing. For better visualisation, a comparative table of the effectiveness of implementing blockchain technologies in document management compared to traditional methods is provided (Table 2).

Table 2. Comparative analysis of traditional document storage methods and blockchain technologies

Parameter	Traditional document management	Blockchain document management
Transparency	Limited, dependent on regulatory bodies	High, all transactions are recorded in the blockchain
Reliability	Susceptible to forgery and loss	Data immutability ensured by consensus algorithms
Processing speed	Slow verification, need for intermediaries	Automated execution of smart contracts
Scalability	Limited by server resources	Easily scalable due to decentralisation
Legal adaptation	Requires notarisation	Smart contracts are legally recognised in some countries
Personal data protection	Vulnerable to information leaks	Secured by cryptographic algorithms
Administrative costs	High due to the need for human oversight	Minimal due to process automation
Information availability	Restricted by server access	Decentralised, accessible to all network participants
Data falsification	Possible through record alteration in the database	Impossible due to the immutability of blockchain records
Integration with other systems	Limited due to centralised architecture	Flexible, supports APIs for interaction with other platforms

Source: created by the authors based on the conducted research

G. Tereshchenko & I. Kyrychenko (2024) highlight that the implementation of blockchain in document management requires not only technical adaptation but also significant updates to the legal framework governing electronic records and their legal force. This ensures a solid legal foundation for the use of decentralised registries in the public sector. Governments in many countries are already working on creating legal frameworks

to legitimise smart contracts and integrate blockchain into government and commercial document management systems. In the United States and the EU, laws are being passed that define blockchain as an acceptable technology for maintaining digital records, opening up new possibilities for its application in information management. Despite existing barriers, blockchain has significant potential to transform document management,

increasing the security and efficiency of working with digital records (Santos *et al.*, 2024).

Recommendations for organisations seeking to implement blockchain technologies

Based on the analysis of case studies and the implementation of blockchain technology in various industries, detailed recommendations for organisations have been formulated. The implementation of this technology requires careful planning, legal compliance, proper staff training, and an assessment of potential risks. Firstly, organisations should assess their readiness for blockchain integration. This includes identifying key processes that can be improved through decentralised technology and developing a detailed roadmap for its implementation (Haber & Stornetta, 1991). The experience of Estonia demonstrates that the integration of e-Tax with state registries significantly simplifies document flow, reducing data processing time and administrative costs (Volosovych *et al.*, 2019). A crucial step is choosing the type of blockchain system. The organisation must determine whether a public, private, or hybrid network is suitable. Private blockchains provide access control to data, while public networks guarantee high security due to decentralisation (Honcharova, 2020).

Legal compliance is a key aspect of integrating blockchain into document management. Organisations should ensure that the implementation of the technology complies with current legislation and regulatory requirements. In some countries, legal mechanisms already exist to legitimise smart contracts and digital signatures (Pantieliieva, 2022), and legislative acts such as UETA confirm the legal force of electronic records (UETA, 1999). Technical implementation and security are also crucial elements. Choosing the right encryption algorithms and data protection systems helps minimise the risk of unauthorised access to information. Implementing multi-factor authentication and using cryptographic methods ensures high data confidentiality (Bilik & Silagin, 2018). Furthermore, effective blockchain implementation is impossible without proper staff training. Organisations are recommended to organise training sessions and seminars for employees and establish internal working groups to monitor the technology implementation process (Volosovych *et al.*, 2019). This ensures a better understanding of the technology and its practical application in work processes.

Additionally, organisations should consider the possibility of integrating blockchain solutions with existing electronic document management systems. The use of API interfaces and compatible technological solutions can simplify adaptation and reduce implementation costs. Furthermore, potential scaling risks should be considered, as increasing the number of users may lead to network performance issues (Galdun *et al.*, 2021). Organisations should also develop data backup and disaster recovery policies, as blockchain, while a secure

technology, does not eliminate the possibility of lost access or technical failures. It is essential to develop clear disaster recovery protocols (Demichev & Kryukov, 2021). After implementation, organisations should evaluate the effectiveness of blockchain. Defining key performance indicators (KPIs) will help assess the technology's impact on business processes. Further scaling depends on the organisation's needs and the results of the initial implementation phase (Pantieliieva, 2022).

Thus, the successful implementation of blockchain technology requires a comprehensive approach that includes analysing the organisation's needs, compliance with legal regulations, technical support, and staff training. By following these recommendations, organisations can increase the transparency, security, and efficiency of their business processes.

Discussion

The implementation of blockchain technology in various sectors has confirmed its effectiveness in ensuring transparency, automating processes, and enhancing data security. This is particularly important for optimising management processes in both the public and private sectors. For example, the integration of the e-Tax system in Estonia has enabled the automation of tax administration, reducing data processing time and increasing trust in government services (Wang, 2022). However, the scalability and high energy consumption of blockchain require further technological advancements, including a transition to more energy-efficient consensus mechanisms such as Proof-of-Stake (Qi-Long *et al.*, 2019). One of the main achievements of blockchain is the increased transparency and security of record-keeping. For instance, land registration in Georgia using blockchain has significantly reduced the number of legal disputes and increased trust in government institutions. This experience demonstrates the effectiveness of decentralised systems in countries with high levels of corruption. However, it is necessary to consider the potential challenges of adapting the system to different legal environments, as the implementation of blockchain requires legislative support and international harmonisation of digital asset accounting standards (Volosovych *et al.*, 2019).

Blockchain is also actively used in the financial sector, where its advantages in security and transparency allow for the optimisation of transaction processes. In the banking sector, the implementation of smart contracts and digital assets reduces the risk of fraud and improves the speed of settlements (Honcharova, 2020). Additionally, in countries with high tax rates, blockchain can provide greater trust in tax policy due to the immutability of records and automated audits. It is also important to note that this technology can improve the efficiency of control and reduce the burden on tax authorities. In the real estate sector, blockchain can reduce bureaucratic barriers and accelerate the conclusion of deals. For example, in the USA, the implementation

of smart contracts has simplified the rental process, positively impacting the real estate market (Santos *et al.*, 2024). However, in many countries, the necessary legal framework is absent, creating legal challenges. For instance, the legal status of smart contracts remains unregulated in many jurisdictions, complicating their use in legal proceedings (UETA, 1999). These issues require close cooperation between government agencies and international organisations to create universally accepted standards for regulating digital contracts.

Another crucial aspect is the need to test blockchain solutions before their widespread implementation. For example, the multi-level testing of e-Tax in Estonia allowed for the identification of potential risks and the improvement of the system before its widespread use (Wang, 2022). A similar approach can be beneficial for other countries and industries, as prior testing can minimise technical risks and enhance data security. However, such an approach requires significant financial investment, which can be a barrier for resource-constrained countries (Pantielieieva, 2022). Additionally, the scalability of the technology remains a significant challenge, and research in this area continues, particularly in terms of expanding the capabilities of blockchain networks without significantly increasing energy consumption.

Involving users at all stages of blockchain implementation is key to its successful operation. Actively informing citizens and businesses, creating open communication channels, and developing training programs can promote wider adoption of the technology. The experience of using blockchain in the banking sector shows that low levels of digital literacy can lead to slow adoption of new systems, even if they are effective (Honcharova, 2020). It is important to develop adaptation programs for employees and the population to overcome barriers to the adoption of new technologies. Additionally, the possibility of expanding the use of technology to create digital identity systems should be considered, as these could form the basis for e-government. Particular attention should be paid to the environmental impact of blockchain. The high energy consumption remains one of the main challenges of this technology, however, the implementation of energy-efficient algorithms such as Proof-of-Stake can significantly reduce the carbon footprint (Haber & Stornetta, 1991). In the future, it is expected that the development of new consensus models will allow for the optimal balance between security and energy efficiency (Demichev & Kryukov, 2021). Meanwhile, a promising direction is the integration of blockchain with green energy, which will allow combining technological innovation with environmental sustainability.

Thus, the successful implementation of blockchain technology requires a comprehensive approach that includes technical, legal, and social aspects. The experience of various countries demonstrates that this technology can become the foundation of digital governance, but its effectiveness largely depends on adaptation to local

conditions and legal norms. Cooperation between governments, businesses, and international organisations is a key factor for the further development and effective implementation of blockchain solutions. It is also important to expand educational initiatives, which will increase public awareness of the benefits and challenges of the technology, contributing to its faster integration into key areas of the economy and public administration.

Conclusions

Blockchain technologies have demonstrated significant potential in the realm of document management, providing high levels of transparency, security, and cost-effectiveness. The use of solutions such as smart contracts and decentralised ledgers has enabled the automation of complex administrative processes, minimising the risk of human error and fraud. Successful case studies in Estonia, Georgia, and the USA have confirmed that the implementation of blockchain contributes not only to reducing costs and speeding up data processing but also to increasing public trust in digital systems due to the reliability and transparency of information processing. In particular, in the public sector, the technology helps to avoid data duplication, ensures the integration of registries, and reduces administrative costs. In the commercial sector, such as the management of rental documentation in the USA, blockchain has demonstrated its effectiveness in reducing errors and the time taken to conclude contracts. The use of cryptographic algorithms such as SHA-256 guarantees the immutability of data and protects it from fraud. This highlights the versatility of the technology, which can be adapted to various sectors of the economy.

Despite this, the widespread adoption of blockchain faces several challenges. Among them are scalability and energy consumption issues, especially for networks using Proof-of-Work algorithms. To address these issues, energy-efficient protocols such as Proof-of-Stake are being actively developed, promising to significantly reduce the resource load. At the same time, adapting the legal framework remains a crucial step in ensuring the compatibility of the technology with existing regulatory requirements. The further development of blockchain requires international coordination. The development of universal standards and integration with global digital platforms open up new opportunities for cooperation between states and businesses. This will not only increase the efficiency of information management but also contribute to ensuring the long-term preservation and protection of data. Blockchain technology has the potential to become a key tool for modernising many areas of activity, creating the foundation for a more transparent and secure digital future.

Promising areas for further research include the development of new methods for integrating blockchain with artificial intelligence systems, which can contribute to the creation of more autonomous and self-regulating

digital processes. Research into the effectiveness of decentralised networks in the context of cybersecurity and data protection also remains relevant, as increasing digitalisation requires new mechanisms for verifying and authenticating information. Additionally, further research can focus on optimising the energy consumption of blockchain technologies, which will allow them to become more environmentally friendly and accessible

for widespread implementation in infrastructure projects and public administration.

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■ Conflict of Interest

None.

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Використання blockchain-технологій у документозберіганні: можливості та виклики

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Анотація. Це дослідження присвячене вивченню потенційних напрямів застосування технологій блокчейн у збереженні документів з акцентом на їхню ефективність, безпеку та економічну доцільність. Визначено ключові переваги цієї технології, зокрема прозорість, незмінність даних, автоматизацію процесів, оптимізацію витрат та зміцнення довіри до цифрових систем. Аналіз практичних кейсів продемонстрував суттєві переваги в різних країнах. Зокрема, в Естонії система е-Таж дозволила знизити кількість податкових порушень на 20 %, прискорити обробку фінансових транзакцій і автоматизувати податковий контроль. У Грузії впровадження блокчейну в земельному реєстрі сприяло зниженню адміністративних витрат на 25 %, скороченню термінів реєстрації власності та зменшенню кількості юридичних спорів на 30 %. У США запровадження смарт-контрактів у сфері оренди дозволило скоротити термін виконання договорів із 14 днів до 48 годин і зменшити кількість адміністративних помилок на 30%. Попри ці переваги, залишаються певні виклики у впровадженні технології, серед яких масштабованість, високе енергоспоживання, правове регулювання та складність інтеграції в існуючі системи. Запропоновано заходи для подальшого розвитку технології, такі як встановлення міжнародних стандартів, адаптація законодавства, впровадження енергоефективних алгоритмів, розширення програм навчання персоналу та інтеграція блокчейну з іншими цифровими інструментами. Крім того, застосування блокчейну підвищує рівень кібербезпеки, оскільки дані, збережені у розподіленому реєстрі, не можуть бути змінені чи сфальсифіковані. Це забезпечує захист документів від підробок, зберігаючи їх автентичність і цілісність. У майбутньому ця технологія може сприяти створенню глобальних систем цифрової ідентифікації, які стануть основою для електронного урядування та безпечного обміну даними. Результати дослідження можуть бути основою для подальших наукових розробок і формування стратегій масштабного впровадження блокчейну в державному управлінні, фінансовому секторі, логістиці та цифровій економіці

Ключові слова: податкова революція; облік і зберігання; децентралізація; Proof-of-Stake; Web3; прозорість і захист



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Current trends in the use of archives for studying the history of information technologies and media

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Abstract. The purpose of the study was to investigate the functionality of digital platforms, technologies used for digitisation and access to archival materials, and to identify problems and potential for improving Ukrainian platforms in the context of archival development and the integration of national initiatives into international digital archives. It was based on the analysis of digital archives and resources of interactive platforms, such as "Google Books", "Digital Public Library of America", "Internet Archive", "Europeana", "Archive.org", "HathiTrust", and "The British Library Digital Collections". The main focus was on the development of digital platforms that play an important role in preserving the cultural heritage and history of information technology and media. The "Europeana" platform has become one of the main examples of successful application of innovative technologies for digitisation of cultural materials. The study examined the development of Ukrainian analogues of digital platforms, in particular, "Diia.Digital education", "Archive of Ukrainian Radio" and "Ukrainian Institute of National Memory". These platforms provide access to digitised materials, which contributes to the preservation of national memory and the development of digital literacy. As a result of the study, a comprehensive analysis of digital platforms for preserving cultural heritage and media history was carried out, in particular, using the example of "Europeana" and its Ukrainian analogues. However, it was noted that the development of these platforms still needed to be improved, in particular, in terms of multimedia content, accessibility to a wide audience, and integration with international digital archives. The importance of further development of technologies for improving access to archival materials and integrating local initiatives with global resources was emphasised, which would deepen interaction between national and international digital archives. Overall, the study highlighted the importance of continuous development of digital technologies for the preservation of cultural heritage and national memory, and highlighted the need for further research and improvement of digital conservation practices, in particular, the integration of national initiatives into global digital platforms

Keywords: document management; digital transformation; resource evolution; data storage; data processing; communication platforms

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Introduction

The history of information technology and media has always been an important topic for research, as these areas have become the main components of modern society, defining cultural, economic, and social transformations. Since the early 2000s, archives have played a significant role in the study of this topic, as they have become a source for in-depth analysis and reconstruction of the past, providing access to numerous archival materials, in particular documents, technical specifications, audio-visual recordings, and user data. I. Matyash (2022) considered the main stages of reforming the archival system, and key problems that arise in the process of implementing new initiatives, such as digitalisation and integration of modern technologies in archival affairs.

Analysis of trends in the use of archival resources for studying the history of information technologies and media is becoming particularly important in the context of technological changes. With the development of digital technologies, the archival practice itself has also changed: from conventional document storage to the active use of innovative approaches and tools. In particular, archives have become important for studying the evolution of technologies, and their impact on society, culture, politics, and worldviews. One of the important aspects that was identified in the current research was the problem of insufficient integration of archival resources with the latest technologies for a comprehensive investigation of the impact of information technologies on society. The paper by D. Saputra *et al.* (2024) provided a systematic review of the advantages and disadvantages of implementing technologies in archival systems. The researchers analysed the impact of digital tools, automation, and artificial intelligence on archive performance, and discussed challenges such as data security and technology dependence.

Currently, large amounts of archival data in the form of texts, images, video and audio materials that are in digital format are actively used for reconstruction and study of various aspects of the development of media and information technologies. The researchers are faced with the need to improve the methodology for analysing archival resources using modern computer and information technologies. The study by N. Zahara & T. Salim (2022) provided a systematic review of the literature on the conservation of digital archives, in particular focusing on current practices, challenges, and strategies for ensuring long-term access to digital resources. Various technological and methodological approaches to maintaining the sustainability of digital archives were analysed. One of the biggest challenges facing archivists and researchers is the preservation and access to digital archival resources containing unique information, in particular due to the rapid obsolescence of technological platforms for data storage. Therefore, the preservation of archives in digital format has become an important topic for many studies. The paper by K. Lobuzina (2017)

considered the development of librarianship in the context of digitalisation, focusing on changes in the structure and functions of libraries, and on new approaches to storing and processing information in digital format. The researcher analysed the role of libraries in the modern information society and their adaptation to digital technologies. In numerous studies that addressed the topic of the impact of digital technologies on archival practice, new concepts of archives related to the use of modern technologies were analysed. For example, L. Opgenhaffen (2022) focused on how digital tools have changed archaeological archiving practices, making it possible to increase the availability of archives and create open archives for broad access to scientific data.

Research by E. Røssaak (2020) highlighted new approaches to the archive that go beyond the traditional understanding of the archive. M. Manoff (2020) and A. Yskak & G. Zhumatay (2022) raised the problem of the transition period of archival theories, where new archival paradigms are formed based on accumulated data, which determine social processes and scientific activities in the modern digital environment. Research by A. Andibor (2024) concerned the importance of information and analytical support for archival institutions in the context of military conflict, in particular, the introduction of digital technologies for storing documents and ensuring access to them. It was emphasised that, given the loss of cultural heritage and archival funds resulting from aggression, it is particularly important to develop digital systems to ensure the security of archives, restore damaged materials and international cooperation to restore access to lost archives. A. Poole investigated the scientific literature on the information activities of community archives. The paper highlighted key aspects of their role in preserving history, accessing information, and strengthening community identity. The study by Rusnaedi (2022) analysed the role of archives in improving the quality and efficiency of administrative services, in particular, their contribution to data availability and management decision-making. The paper emphasised that the introduction of systematic archival practices is an important factor in improving the work of institutions. Current research trends related to the behaviour, needs, and expectations of archive users in the digital age have been investigated by C. Harris (2010).

Digital archives are becoming not only tools for storing information, but also important tools for reconstructing cultural and social processes that took place at different stages of technology development. The challenges associated with archiving and storing digital data require new approaches to integrating humanitarian and technical knowledge, and the use of modern methods of big data analysis and machine learning. Preserving archival materials in digital format is a key challenge for researchers, as it preserves unique documents and provides access to them for future generations. However,

there are constant problems with the technological obsolescence of storage platforms, which requires constant updating of archive systems and storage strategies.

The purpose of this study was to analyse modern approaches to the use of archives in the field of media and information technology studies, and to assess the effectiveness of the latest methods, in particular, through the integration of digital archives, audio-visual materials, and other modern sources.

Materials and Methods

The study included a comparative analysis of digital platforms for accessing digitised scientific and cultural materials, in particular, such platforms as "Google Books" (n.d.), "Digital Public Library of America (DPLA)" (n.d.), "Internet Archive" (n.d.), "Europeana" (n.d.), "Archive.org" (n.d.), "HathiTrust" (n.d.), and "The British Library Digital Collections" (n.d.). Each of these platforms offers unique opportunities for accessing digitised resources, including books, academic papers, technical documents, and media materials. As part of this study, various digital platforms specialising in digitised cultural and scientific resources were used to collect and analyse materials. Firstly, 10 major platforms were selected, including "Google Books", "Digital Public Library of America (DPLA)", "Internet Archive", "Europeana", "HathiTrust", and the "British Library Digital Collections". The selection criteria included the availability of academic resources, historical documents, media materials, and tools for deep data retrieval and analysis.

"Google Books" has become an important tool for gaining access to the full texts of books, which helped to conduct a comparative analysis between different researchers and stages of information technology development in the media. The platform provided powerful search functions, and tools for automating citation, which makes it easier to process a large number of materials. To obtain additional materials about digitised publications, the "DPLA" platform was used, which provided access to various scientific publications, archival resources, and media materials in the United States. "Internet Archive" has become an important resource for working with multimedia materials and digitised books, especially for analysing the use of technical tools in the media sphere, because the platform has a large number of rare documents related to the development of technologies. For the study of cultural and scientific aspects, "Europeana" was used, which collected collections of materials from European archives, which allowed assessing the impact of information technologies on European cultural heritage.

The selection of platforms for analysis was determined by the number of digitised materials available, the availability of interactive functions, and tools for deep search. In addition, platforms that specialise in digitising rare or archival documents were chosen because of their importance for analysing changes in the media

space. From the initial set of materials, 30 sources were selected, including various types of information, from books to research papers and media materials. After further screening, mainly due to relevance to the research topic, 18 sources remained that were included in the list of references. This helped to obtain a balanced sample of sources for deep analysis of information technologies and media in the context of digital platforms. Thus, the use of the above-mentioned platforms allowed creating a database for analysis, which became the basis for conducting a comparative study of innovative approaches in digital archival affairs.

The review method helped to evaluate the tools that platforms used to process and provide access to digitised materials, in particular, semantic search, data visualisation algorithms, and text recognition technologies, which greatly facilitated the process of searching and interacting with digital resources. Special attention was paid to comparing the "Europeana" platform with its Ukrainian counterparts, such as "Diia.Digital education" (n.d.), "Archive of Ukrainian Radio" (n.d.), "Ukrainian Institute of National Memory" (n.d.), and "Electronic Archive of the Liberation Movement" (n.d.). The comparison was based on several criteria: access to digitised materials, availability of search tools, data visualisation, and interactive platform capabilities. Based on the results obtained, recommendations were formulated for improving Ukrainian platforms using the deduction method. This method helped to draw general conclusions, starting with specific observations and analysis of the results obtained at the stage of research of digital platforms. In particular, based on a comparative analysis of the functionality of international platforms, effective tools for searching, automating citation, and classifying data were identified. Based on these observations, recommendations were formulated, focusing on the needs of Ukrainian users and the specifics of the national context.

Results

Main challenges in archival information technologies and media

Research in the field of information technology (IT) and media requires the integration of knowledge from numerous scientific disciplines, which determines their interdisciplinary nature. In particular, a comprehensive analysis requires a combination of knowledge from engineering, computer science, sociology, cultural studies, psychology, linguistics, and media theory. The complexity of the topic is conditioned by the rapid evolution of technologies, which forces researchers to apply new methods of analysis and approaches to understanding the content and impact of media. Rapid changes in technologies make it difficult to track and record the stages of their development. The history of IT requires not only a technical, but also a deep cultural and social context, as new technologies often lead to social changes that can be difficult to reflect in traditional archival materials.

In this regard, there is a need to apply flexible approaches to the study of technological changes, including the integration of various data and analysis at various levels – from engineering to socio-cultural transformations. The issues of preserving archival materials, accessing them and ensuring ethical standards in working with confidential information are important, so the digitalisation of archives, and new methods of data analysis, open up new horizons for research in these areas, but are accompanied by numerous challenges that require constant adaptation of methodological approaches.

Digitalisation of archival materials is an important aspect in the study of the history of information technology and media. Digital archives allow storing and presenting materials covering various stages of it and media development in an accessible way. However, it is important to note that the process of digitising documents and creating digital archives is accompanied by a number of difficulties, such as the need to ensure compatibility of formats, protection against data loss due to outdated media, and support for long-term access. One of the biggest challenges in preserving digital archives has been the rapid degradation of storage media and the obsolescence of storage technologies. From the 1960s to the 2020s, there were constant changes in information storage formats. From the use of magnetic tapes in the 1960s and 1970s for storing large amounts of data, through the popularisation of floppy disks in the 1980s and 1990s, CD-ROMs in the 1990s and DVDs in the 2000s, to the introduction of modern storage technologies such as USB drives, cloud storage, and solid-state drives (SSDs) in the 2010s and 2020s.

These changes reflect significant progress in the development of computing technologies and changing approaches to storing and accessing information. However, old storage media that stored important historical or technical documents often turned out to be physically damaged or technically outdated. For example, magnetic tapes, floppy disks, or CD-ROMs cannot be used seamlessly on modern computers without additional programmes or hardware devices. This led to serious problems with access to data that contained unique information about the development of information technologies and media. In addition to the physical ageing of media, another big problem was the lack of uniform standards for storing and migrating data between different formats and platforms. As a result, when trying to transfer old data to new media or restore access to it, compatibility difficulties may arise. This could lead to the loss of some important information or complicate its analysis in the future. To solve this problem, it was necessary to develop clear standards for data storage, in particular, the use of open formats that ensure the safety of information for a long time.

Archival documents related to the history of information technology were often extremely difficult to analyse. They contained numerous technical terms,

mathematical formulas, algorithms, circuit design, and software source code. Without specialised knowledge, the analysis of such materials was much more difficult. Interdisciplinary collaboration between historians who investigated cultural heritage and technical experts with experience in programming, electronics, or computing was important. This collaboration allowed for a deeper understanding of the specifics and significance of archival materials, as technical aspects could influence the understanding of cultural, social, or historical contexts. The involvement of qualified specialists significantly increased the time and resources spent, since it was necessary not only to study the documents themselves, but also to reconstruct or restore old software solutions that might not be suitable for modern use. In this regard, the investigation of such materials often requires the use of specialised methods, such as machine learning or natural language processing (NLP), to analyse large amounts of data containing technical information.

Media content analysis is an important aspect of media development research. Technologies such as artificial intelligence, automated content generation, and big data are changing the traditional way media products are created and consumed. This not only transforms the media landscape, but also changes the audience's interaction with content. In particular, more and more attention is being paid to personalised media content, data visualisation, and interactive media platforms that allow users to actively interact with content and create new forms of expression. Research on the impact of such technologies requires new approaches to content analysis, including not only conventional methods such as content analysis, but also the use of machine learning algorithms to study media data arrays, in particular texts, images, and videos, often faces numerous ethical and legal challenges associated with accessing documents that contain sensitive or sensitive information. This may apply to users' personal data, communications, corporate events, or even archives containing military or government information. Key ethical issues arise when dealing with private correspondence, databases, or information containing intellectual property, especially in the context of emerging technologies such as artificial intelligence, big data, or automated decision-making systems.

Such materials could contain important information for research, but there was also a high risk of violating the privacy and privacy rights of the individuals mentioned in these documents. Ethical dilemmas concerned the balance between the right of access to historically important documents and the need to protect private data. Therefore, many archives containing sensitive information used access restrictions or special protocols to work with such documents. This may include restricting the publication of parts of documents or requiring special permissions to access certain types of information. This created significant difficulties for researchers, as it could restrict access to important sources and

require legal advice. From this standpoint, it was important to develop ethical protocols and standards for working with sensitive data that met modern privacy and security requirements. This included the use of anonymisation of data, ensuring reliable protection of information, and strict regulation of access rights to archival materials.

These factors require the introduction of specialised information management systems that allow efficient organisation and cataloguing of materials, and providing the necessary mechanisms for long-term data storage. It is also important to consider that many archival materials relate to intellectual property, so it is necessary to ensure legal transparency of access to such resources. The issue of creating effective strategies for digitisation and long-term storage of digital archives was also important. The process of digitising large archival collections took a significant amount of time and resources, but it was crucial for the preservation of historical documents. If this process was not properly organised, it could lead to the loss of a significant part of the cultural heritage that was of great importance for understanding the development of technology and society. With this in mind, one of the main tasks was to create platforms and databases that allowed organising and presenting complex technical materials in an accessible way. However, such systems required the integration of knowledge not only on the history of technology, but also on programming and computer science to ensure the possibility of correct interpretation and adaptation of archival materials to modern needs.

Contemporary historical studies on information technology and media were increasingly based on archival materials that were stored in both physical and digital formats. Archives such as the "Computer History Museum" (USA) (n.d.), "Archives of IT" (UK) (n.d.) and "Deutsches Technikmuseum" (Germany) (n.d.) actively digitised their collections, which allowed researchers to work with materials remotely. The digitisation process not only increased access to sources, but also ensured their long-term preservation by protecting them from physical deterioration. Based on the use of modern scanning technologies, metadata and specialised software for managing digital collections, archives created multifunctional databases. They provided keyword search, filtering by timeline or topic, and viewing high-quality digital copies of original documents.

A special feature of working with digital archives was the ability to integrate an interdisciplinary approach, which allowed historians not only to analyse specific materials, but also to correlate them with global processes of technology and media development. For example, data on technical innovations from digital archives can be combined with the economic, social, and cultural contexts of the era in which they were created. In addition, the digital format has contributed to the development of new analysis methods, such as using machine learning algorithms to classify documents or detect

hidden patterns in large data sets. This approach to working with archives greatly facilitated access to unique materials that previously remained poorly studied due to geographical remoteness or limited access to physical funds. For example, documents about early computer systems or the first media platforms stored in digitised form became the basis for numerous studies that focused on investigating the evolution of technology. Historical research in information technology has received a new impetus for development. They not only documented the past, but also formed new concepts that helped to better understand the impact of technology on the present. Thus, the digitalisation of archival materials has become a key factor that has identified new opportunities for studying the history of information technology and media, stimulating both the development of science and international cooperation between institutions.

The role of global digitisation platforms in accessing scientific and technical resource

Digitalisation processes significantly transformed access to a large amount of data, in particular, to technical documentation, research papers, patents, drawings, and correspondence between developers of the first computers and media systems. Such resources provided researchers with the opportunity to systematically analyse materials that previously remained inaccessible due to physical or geographical restrictions. Global platforms such as "Google Books", "Digital Public Library of America (DPLA)", "Internet Archive", "Europeana", "HathiTrust", "Archive.org", "The British Library Digital Collections" etc., played a significant role in this process.

"Google Books" is one of the largest and most well-known book collection digitisation projects implemented by Google as part of an ambitious plan to create access to complete texts of books, scientific publications, technical manuals, and other documents. The idea of this project is to provide access to millions of digitised publications from the libraries of the world's leading educational and scientific institutions, as well as private collections. With this project, users get access to texts that can usually only be accessed through physical libraries or through expensive subscriptions. "Google Books" not only digitises books, but also automatically creates metadata and bibliographic records, which allows performing an accurate search for all the contents of the book. The "Google Books" search engine is capable of performing deep text analysis, highlighting keywords, and offering various filters for users. This makes the platform extremely valuable for researchers who study literature in various disciplines. A special feature of "Google Books" is the ability to automate citation. The platform allows users to quickly find citations and integrate them into scientific papers using tools that automatically generate bibliographic entries in various styles (APA, MLA, Chicago, etc.). This is especially useful for researchers who analyse literature within the

framework of large studies, as it greatly simplifies the documentation process and reduces the likelihood of errors in the design of citations. "Google Books" also supports the ability to compare texts, which allows researchers to check different editions of the same book or compare versions of the same paper. This is an important tool for investigating the evolution of scientific ideas, because it allows identifying changes in the editorial offices of texts and their impact on the development of relevant scientific theories. The "Google Books" project covers a wide range of sources, including rare and ancient publications that are valuable for studying the history of scientific and technical disciplines. It also provides access to a large number of publications that were previously available only in a limited number of libraries or archives, which makes the platform indispensable for researchers involved in the history of technology.

The "Digital Public Library of America (DPLA)" is an important online resource that brings together digitised collections from libraries, museums, and archives in the United States. This project has become one of the largest initiatives to create unified access to digitised materials covering various aspects of history, culture, and technology. "DPLA" provides free access to materials from archives, libraries, and museums across the United States, covering millions of documents in various forms, from texts and manuscripts to videos and images. The main purpose of "DPLA" is to provide access to rare and important documents that are important for the history of not only the United States, but also for world history. The platform's collections contain many technical descriptions, drawings, correspondence, and other materials that allow researchers to study the development of technologies, especially in areas such as computer science, electronics, and mechanics. The uniqueness of these materials lies in the fact that they are provided in digitised form, which greatly simplifies access to such important historical documents. "DPLA" also provides access to scientific research and articles related to technology development, engineering, and personal correspondence of early innovators. This is extremely important for studying the stages of development of key technological innovations. All of these resources are located in a single catalogue, allowing users to easily search by topic, timeline, or geographic region, making the platform extremely convenient for use in research. A special feature of "DPLA" is also its open access, which allows users to use most resources for free. This makes the platform accessible to a wide range of researchers, students, teachers, and other interested parties involved in studying the history of scientific achievements and technological progress.

"Internet Archive" is one of the largest and most important platforms for storing and providing access to digital materials. This platform digitises and stores a huge amount of content, which includes books, videos, audio files, software, and web page preservation. The

"Internet Archive" provides access to more than 40 million pieces of content, making it an important platform for research in the history of information technology, science, media, and cultural heritage. A special feature of this platform is its ability to store a wide range of media formats, which is important for research in the field of digital technologies and their impact on modern culture. Users can access rare technical documents, videos, audio files, and software that has become part of the scientific and technical heritage. For example, large software archives that are stored on the "Internet Archive" can be used to study the evolution of programming and the development of operating systems. Machine learning tools used on the platform allow effectively classifying and recognising texts, which greatly facilitates the process of searching and analysing large amounts of information. This is especially important for research related to the analysis of technological innovations, as it allows finding rare documents or publications that were previously available only in a limited format. The "Internet Archive" provides free access to most of its materials, making it an essential research tool available to both professional scientists and amateurs. Users can upload, save, and use documents for their own research, thereby making a great contribution to preserving the digital heritage.

"Europeana" is a European digital platform that provides access to cultural and scientific materials digitised from various European archives, museums, and libraries. "Europeana" brings together collections from more than 3,000 European institutions, which gives the impression of a single access to a huge amount of European cultural heritage. This includes books, manuscripts, maps, photographs, artefacts, and other valuable materials reflecting various aspects of European history, culture, and science. The "Europeana" platform is particularly useful for researchers who study European history, art, science, and technology. Due to search tools and interactive features, users can quickly find the necessary documents and resources, which greatly facilitates working with large amounts of information. A special feature of this platform is its versatility: it allows searching by various criteria, such as the type of material, time, and geographical affiliation, and topics, which makes "Europeana" a powerful tool for research and training. The only thing that makes "Europeana" even more unique is its focus on integrating not only text materials, but also audio-visual resources, which allows exploring historical events and cultural phenomena through various media formats. This makes the platform an important tool for studying not only the history of scientific discoveries, but also the development of cultural and technical traditions in Europe.

"Archive.org" is another important project aimed at digitising and preserving media content, which includes movies, audio, web pages, software, and other digital documents. It is not only a library in the traditional sense, but also a huge digital data archive that provides

access to millions of documents, videos, and software. "Archive.org" – has become one of the largest platforms for preserving cultural and scientific heritage, which covers not only traditional documents, but also new media formats that have emerged with the development of digital technologies. A special feature of this platform is its interface, which allows users not only to search and view materials, but also to actively download and use the output files. "Archive.org" provides access to large archives of digital libraries, which allows researchers to analyse the evolution of technologies, in particular, the history of the development of the Internet, software, and computer science. This platform is also an invaluable resource for exploring various aspects of scientific and technical history. "Archive.org" contains archives with digitised copies of scientific publications, technical reports, and software tools that allow tracking the history of the development of various technologies. It is also worth noting the importance of archiving web pages, which allow storing the content and structure of internet sites over time, which is important for analysing changes in the context of technological progress and the development of digital information.

"HathiTrust" is one of the largest digital archives focused on preserving academic and scientific resources. This project brings together the resources of university libraries and provides access to millions of books, scientific papers, journals, and other materials digitised as part of the scientific heritage preservation initiative. "HathiTrust" is an important source for researchers, as it provides access to a variety of academic publications in various disciplines covering most of the scientific activities of past centuries. Based on powerful tools for finding and processing big data, the platform provides convenient access to scientific materials, which allows researchers to quickly find the necessary publications and use them for their work. "HathiTrust" also has a well-developed cataloguing system that provides

efficient search and allows for detailed analysis of scientific papers, in particular, in the field of technology history. The platform is a valuable resource for those who study scientific achievements in various fields, as it provides access to texts that are often unavailable through traditional libraries or archives. An important aspect is that "HathiTrust" also provides access to rare and outdated publications, which is extremely important for studying the evolution of scientific ideas.

Digitised collections "The British Library Digital Collections" is one of the most important resources for research in various fields. The "British Library Digital Collections" is one of the largest and most famous libraries in the world, with many rare documents, manuscripts, maps, and other historical materials in its collection. The "British Library Digital Collections" allows researchers from all over the world to access these rare and valuable resources in digitised form. This platform is especially important for those who study the history of science and technology, as it contains many technical documents, scientific papers, and manuscripts that can shed light on the stages of development of various technologies. Access to rare collections allows not only to study historical aspects of the development of science, but also to analyse the evolution of theoretical approaches and methods in various fields. In addition, "The British Library Digital Collections" provides very detailed cataloguing, helping to perform a deep search on specific subjects, historical stages or topics. This makes the platform an essential tool for researchers involved in studying documents related to the history of science, technology, culture, and society. Table 1 provides detailed information about the main platforms that offer access to digitised sources, such as "Google Books", "Internet Archive", "HathiTrust" etc. It contains a description of the characteristics, content types, tools and technologies, and the specialisations of each of the platforms, which allows for a comprehensive analysis of their capabilities.

Table 1. Comparative analysis of digital platforms for accessing digitised scientific and cultural materials

Platform	Main features	Content type	Tools and technologies	Specialisation and unique opportunities
Google Books	Large-scale project to digitise the book collections of the world's leading libraries.	Books, scientific publications, technical manuals	Text search, automated citation, bibliography creation, comparative analysis of texts	Access to full texts, search tools for effective work with a large number of sources.
Digital Public Library of America (DPLA)	Unified access to digitised collections of libraries, museums, and archives in the United States.	Technical descriptions, drawings, correspondence, research	Cataloguing, searching, and accessing rare materials	Digitised materials on the history of computer science, personal correspondence, and documents of early researchers.
Internet Archive	Digitisation of books, magazines, videos, programmes, and other media.	Books, audio, video, software	Machine learning for data classification, text recognition, digital archives	Wide range of materials on the history of digital technologies and cultural aspects.
Europeana	European platform for access to digitised cultural and scientific materials from various European archives.	Artefacts, documents, maps, photos	Search tools, interactive features	Digitised materials from various European archives, history of technology, culture, and science.

Continued Table 1.

Platform	Main features	Content type	Tools and technologies	Specialisation and unique opportunities
Archive.org	Digitisation of various media, including films, sounds, and web pages.	Technical documents, media content	Technologies for processing and storing large amounts of data	Access to media, software, and archives on scientific and technical history.
HathiTrust	Digitisation of academic resources, including university libraries.	Scientific papers, books, magazines	Text search, big data processing	Access to scientific and technical publications, tools for research in the field of technology history.
The British Library Digital Collections	Digitised collections from the British Library archives, including rare materials.	Rare documents, manuscripts, maps	Search interface, detailed research of historical materials	Digitisation of rare and important historical and technical documents, access to special collections

Source: compiled by the authors

The scientific significance of such resources was that they helped to form an interdisciplinary approach to the study of the history of information technology. In particular, the analysis of technical descriptions in combination with the study of correspondence and public speeches of developers contributed to the disclosure of their personal motivations, cooperative work models, and strategies for solving technical and scientific problems. For example, researchers could study how theoretical knowledge was integrated with practical engineering solutions in the development of the first computers.

An important aspect was also that digital archives contributed to the development of new research methods. The use of machine learning tools and word processing algorithms helped to classify large amounts of data, identify hidden trends and correlations between different sources. As a result, this provided new models for the reconstruction of historical processes and a deeper understanding of the impact of technology on society. Thus, the digitalisation of archives and the creation of interactive platforms have become an important stage in the evolution of historical information technology research, laying the foundation for new approaches to studying the past and forming knowledge about the technological heritage of humanity.

Analysis of the “Europeana” platform in the context of Ukrainian analogues and proposals for improving archival affairs in the context of information technology and media development

Resources like “Europeana” have become innovative platforms that not only provide access to large amounts of archival materials, but also provide interactive data exploration due to modern technological solutions. They served as central hubs for bringing together Europe’s cultural heritage, including digitised documents, images, audio-visual materials, and 3D models. One of the key advantages of “Europeana” was the integration of advanced search functions. The platform’s tools allowed filtering by various criteria, such as subject, period, geographical region, or material type, making navigation much easier for researchers. In addition, semantic search

algorithms were used to identify semantic relationships between documents, contributing to a deeper understanding of the context. Built-in visualisation features also significantly expanded the analysis capabilities. For example, interactive maps, timelines, and graphs allowed researchers to track historical processes, technological changes, or the evolution of cultural phenomena in space and time. These tools helped to create a visual representation of large amounts of data, which was important for interdisciplinary research.

Another important aspect of “Europeana” was the possibility of collaboration between researchers. The platform provided tools for creating thematic collections, sharing discussions, and commenting on archival materials in real time. This approach stimulated the collective development of knowledge, the exchange of ideas and the integration of new scientific approaches. Thus, “Europeana” not only ensured the preservation and access of cultural heritage, but also offered innovative tools for its interactive study. This opened up new perspectives for researchers in the humanities and social sciences, contributing to the globalisation of scientific approaches and improving the efficiency of working with archives. “Europeana” has become an example of how digital technologies can transform approaches to the preservation, research, and promotion of cultural heritage. By combining convenient access to data with modern data analysis tools, the platform has changed the way people think about the possibilities of digital archives. In addition, “Europeana” actively supports educational initiatives, providing educational institutions and institutions with open access to digitised resources. This allows the platform’s materials to be integrated into curricula, contributing to the development of digital literacy and cultural heritage interest among students. It is especially important that access to such resources is free, which makes the platform accessible to a wide audience, regardless of geographical location or financial capabilities. “Europeana” has become a tool for preserving lesser-known or local elements of European culture that might have gone unnoticed or lost. For example, the platform allows storing and exploring rare manuscripts,

folklore records, local traditions, and even architectural monuments. The openness of "Europeana" and innovation make it not only a convenient tool for researchers, but also a powerful tool for preserving cultural heritage for future generations. This demonstrates how effectively technology can serve as a bridge between the past, present, and future.

Ukrainian digital platforms specialising in preserving and popularising national memory and digital education have significant potential, but their development requires further improvement. A detailed analysis of each platform allows identifying their capabilities and identifying key shortcomings that hinder effective use. Platform "Diia.Digital education" is a modern tool for teaching digital skills to the population of Ukraine. It offers more than 100 free courses in the format of educational series covering topics from basic gadget use to cybersecurity and entrepreneurship. One of the key advantages is an interactive approach to learning: users can watch video lectures, take tests, and receive certificates confirming their knowledge. The platform provides accessibility for people with disabilities through adapted interfaces and subtitles. However, the main disadvantages are the lack of courses for highly specialised professions, for example, for archive workers or historians, and insufficient integration with other educational resources. Expanding the content and developing a section aimed at children and teenagers will make the platform more versatile. Integration with archived databases and the creation of modules for working with historical sources will significantly expand the user audience.

The "Archive of Ukrainian Radio" is a unique resource that focuses on preserving audio materials that cover a wide range of topics – from historical programmes to concert recordings. This platform provides access to phonograms, which are often the only evidence of past events. Its advantages are a clear archive structure, the ability to search by genre, date, and topic. However, the archive has limitations, in particular, the lack of transcription functions for audio files, which reduces its availability for people with hearing impairments or those who are looking for text versions of materials. Mobile application development, integration with other media archives, and the introduction of automated transcription tools will contribute to better material availability. The "Ukrainian Institute of National Memory" is a platform that focuses on spreading historical knowledge through

documents, research, and educational initiatives. One of its strengths is the organisation of virtual exhibitions, which allows users to dive deeper into topics such as the Holodomor or the struggle of Ukrainians for independence. The platform also offers analytical materials that can be useful for researchers and teachers. The weak point of the platform is the limited search functionality, which makes it difficult to work with large amounts of data, and weak popularisation among young people. To solve these problems, it is necessary to improve the interface, create a mobile version of the platform, and develop interactive educational materials, such as videos or game simulations of historical events.

"Electronic archive of the liberation movement" (e-Archive) is one of the largest projects dedicated to the preservation of historical documents about the struggle for independence of Ukraine. Its collection includes photographs, diaries, postcards, maps, and other materials that are organised by subject, chronology, and geography. The archive is actively updated due to cooperation with researchers and scientific institutions. The advantages include detailed cataloguing and availability of documents for download. However, the platform is not sufficiently developed in the multimedia aspect: there are not enough audio and video materials that could interest a wider audience. The introduction of multimedia content, integration with educational platforms, and expanding access to archives through mobile applications will be important steps to improve its effectiveness.

In general, to improve Ukrainian platforms, it is necessary to ensure greater integration of archival and educational resources, creating a single digital space for preserving national memory. Key recommendations include developing mobile applications, improving search engines using semantic analysis, and expanding multimedia content. It will be important to attract young people through social networks, interactive programmes, and educational campaigns. The integration of artificial intelligence to automate transcription and data analysis, and close collaboration between platforms, will help to create a modern ecosystem that meets the needs of users and preserves cultural heritage for future generations. Table 2 provides a comparative analysis of digital platforms that provide access to digitised scientific and cultural materials, indicating their main functions, advantages, disadvantages, and recommendations for improvement.

Table 2. Comparison of digital platforms for accessing digitised materials

Platform	Main functions	Advantages	Disadvantages	Recommendations for improvement
Europeana	Access to cultural heritage archives, semantic search, data visualisation	Interactive search, visualisation, research collaboration, educational initiatives	Insufficient attention to local initiatives, limited multimedia content	Multimedia expansion, support for local resources, integration with school programmes
Diia.Digital education	Online courses, certification, adapted interfaces for people with disabilities	Interactive approach, accessibility, wide range of topics	Lack of highly specialised courses, poor integration with other platforms	Content extensions, modules for working with historical sources, children's section

Continued Table 2.

Platform	Main functions	Advantages	Disadvantages	Recommendations for improvement
Archive of Ukrainian Radio	Save audio materials, search by genre and date	Uniqueness of materials, structured archive	Lack of transcription, poor accessibility for people with hearing impairments	Automated transcription, mobile application, integration with other media archives
Ukrainian Institute of National Memory	Virtual exhibitions, analytical materials, historical research	Convenience for researchers, thematic collections	Insufficient popularisation among young people, limited search functionality	Interactive interface, mobile version, game simulations of historical events
Electronic archive of the liberation movement	Archive of documents, photos, postcards, systematisation by topic	Detailed cataloguing, availability for download	Limited multimedia content, insufficient integration with other platforms	Multimedia content, mobile applications, training modules

Source: compiled by the authors

Recommendations for improving archival affairs using innovative platforms in the context of information technology and media development have a direct impact on the effectiveness of preserving, analysing, and popularising cultural heritage in the digital age. The integration of advanced technologies, such as semantic analysis and automatic transcription of text and audio-visual materials, is directly related to modern methods of data processing and storage in the field of information technology. The use of such tools provides not only quick access to the necessary information, but also the possibility of deep data analysis based on media and digital technologies. Expanding multimedia content, including interactive elements, 3D models, and videos, is also an integral part of modern media tools that significantly increase the level of user interaction with archived resources. Data visualisation using tools that are actively used in the media sphere makes archives accessible and understandable to a wide audience, including young people who actively use multimedia platforms in their education and leisure activities.

Mobile solutions in the context of digital archives allow users to access archival materials on any device at a convenient time. They respond to the current demand from media platforms and technologies that provide constant access to information, including through mobile applications. It also increases the availability and usability of digital archives, which is an important condition for the effective use of these resources in the modern information environment. The integration of archives with educational platforms is an important aspect of the development of information technologies in the educational process, contributing to the development of digital literacy. Creation of thematic collections, interactive lessons, and simulations of historical events will allow combining archival resources with modern media technologies that open up new opportunities for learning and popularising cultural heritage among young people.

The popularisation of archives through social networks, virtual tours and webinars reflects the active use of media channels to attract a new audience. Cross-platform cooperation will create unified digital spaces for

data exchange and resource integration, which is an important element for the development of modern archival systems, where information technologies and media occupy a central place. The development of accessibility through the adaptation of interfaces for people with disabilities, in particular, the use of text and subtitle reading technologies, promotes inclusion in the digital environment and meets the requirements of modern media platforms that strive to ensure equal access to information for all categories of users. Thus, digital platforms, in particular "Europeana", embody an innovative approach to preserving cultural heritage, providing convenient access to digitised materials and modern tools for their analysis. Ukrainian analogues, such as "Diia.Digital education" and "Archive of Ukrainian Radio" play an important role in the development of national archives through the introduction of the latest media technologies and improving access to cultural resources. The introduction of innovations in the field of archival affairs will not only preserve historical materials, but also actively involve new generations in the study of cultural heritage, creating interactive opportunities for learning and media consumption in the digital age.

Discussion

During the study, attention was focused on analysing the main trends in the development of digital archives, in particular, considering the latest technologies and their impact on the preservation, availability and distribution of archival materials. For comparison, several important scientific papers related to this topic were considered, in particular, research on the digitisation of archival materials, the use of social media in archival practice, and strategies for preserving cultural heritage in digital format. One of the first papers analysed was the study by G. Boryak (2002). In her work, the researcher investigated the problems associated with the organisation of electronic archives, focusing on the need to standardise and ensure high quality of digitised data for publication on the Internet. G. Boryak noted the importance of adapting archives to digital formats, which is an important element for ensuring their availability. The research focused more

on the theoretical aspect of organising archival publications. G. Boryak's study raised the issues of presenting archives on the Internet, but did not consider in more detail the latest technologies that are actively used to provide access to these materials, which makes our research an addition to her study.

The study by L. Bountouri & G. Giannakopoulos (2014) proved important for our analysis by investigating the impact of social media on archival affairs. The researchers noted the importance of using social media to promote archival resources and attract a wider range of users to interact with archives. They emphasised the possibility of social networks to be not only a channel for distributing archival materials, but also a platform for storing information. However, in contrast to their study, which focused more on the role of social media as a channel for access to archival materials, the current research focused on a more complex issue: how technologies, in particular digitisation and Internet platforms, change the very practice of archives and the availability of data. Thus, the analysis helped to better understand the context of social media use, but at the same time focused on more general aspects of archive digitalisation compared to the approaches of the authors of this study. Research by K. Müller (2021) provided an in-depth look at the problem of digitising cultural heritage and creating online access to archives. K. Müller emphasised the importance of ensuring quality and accuracy in digitising archival materials and highlighted the need to preserve cultural heritage for future generations. This study was the basis for the analysis of the preservation of archives, but unlike K. Müller's paper, the study focused not only on the issue of preserving cultural heritage, but also on technological tools that allow effective access to these materials. K. Müller's research focused more on creating digital collections for cultural heritage than on exploring the role of archive platforms for practical user access.

Another study that was analysed was the paper by B. Cannelli & M. Musso (2022). The researchers examined the role of social media in the context of personal digital archives, focusing on how users store personal data through platforms such as Facebook, Instagram, etc. They noted that social media can be an important tool for preserving personal memories and creating personal archives, which is a new aspect compared to traditional archives. The study provided important insights into how the concept of archives is changing in today's digital environment. However, the current study focused on the broader context of archival affairs, which included not only individual archives, but also professional archives of cultural heritage and public archives, digital technologies. The study by B. Cannelli & M. Musso (2022) focused more on the individual level of use of social media as personal archives, while the current research considered professional archives that have their own requirements for accuracy, preservation of authenticity of materials, and the possibility of large-scale access to them. The

investigation of social media in the context of personal archives is an important step towards understanding changes in the concept of archives in the digital age, but it requires a more detailed consideration of the specific requirements for cultural heritage archives, which are of greater value to history, culture, and science.

The conducted research and the paper by B. Şentürk (2014) had both common and distinctive aspects that could be compared from several standpoints. Both papers highlighted the importance of archival materials for studying history and technological change. The current study focused on the use of archives to investigate the evolution of information technologies and media, in particular, the use of the latest data processing methods for analysing archival materials. The study by B. Şentürk, in turn, looked at more general aspects of online access to archival materials, in particular, the advantages and challenges associated with the digitalisation of archives. The study also focused on integrating the latest technologies, machine learning, thematic modelling, and data visualisation for deep analysis of large amounts of archived data. This helped to conduct a detailed analysis and identify hidden connections between different sources. The paper by B. Şentürk, in turn, focused on the digitalisation of archives and the opportunities that open up due to online access, but without such a deep emphasis on technological methods. Both studies also raised issues and challenges related to the processing and access of archival materials. The current study focused on the difficulties that arise when processing big data and the problems of translating rare languages, which significantly complicated working with archival materials. However, the study by B. Şentürk discussed issues of security of archival materials on the Internet, issues of confidentiality and preservation of archival consciousness. Another difference is that the study had a unique focus on using machine translation techniques to work with rare languages. This helped to expand access to archival materials that were previously unavailable for analysis due to language barriers. This aspect was not considered by B. Şentürk. In general, both studies shared common goals regarding the importance of archives and the use of the latest technologies for their research, but differed in focus and methodology. This study focused on the investigation of the history of information technology and media using sophisticated big data analysis techniques and language processing technologies, while B. Şentürk's research focused on the general challenges and prospects of online access for archives and archivists.

The conducted research and the paper by J. Bergis (2018) also had both common and distinctive aspects. Both papers highlighted the importance of archival materials for investigating social processes and technological change. This research focused on the use of archives to study the history of information technologies, and media, in particular, the use of the latest data processing



methods for analysing archival materials. In turn, J. Bergis emphasised the importance of archiving content created by social movements in real time, which has become increasingly important for studying modern social and political processes, in particular, in the context of using social networks. Both studies also recognised the importance of using the latest technologies in the archiving process, although their applications were different. Jules' study focused on the problems of archiving digital materials, in particular content in social networks, and on developing new methods for collecting and storing such data, which required new approaches and technologies.

In addition, both studies considered important ethical aspects of archiving. This paper focused on preserving archival consciousness, data protection, and issues related to big data processing and maintaining privacy. Jules' research focused on the ethical challenges that arise when archiving content from social movements, in particular, consent, confidentiality, and the use of materials for future research. This included consideration of the privacy rights of members of social movements and access to publicly available content in the context of archival work, which became important due to the rapid development of digital technologies and the possibility of storing large amounts of data.

The main difference between the research conducted and the paper by J. Bergis was the focus of the study. This research focused on the investigation of the history of information technology and media through archives and the use of technologies for processing and analysing big data, while J. Bergis focused on a specific aspect of archiving – the collection and storage of digital data created by social movements in real time. This included new methods of collecting and storing data that addressed specific issues, such as the speed of change in social media and the ethical issues associated with archiving such content. Jules' research also focused more on practical recommendations for archiving digital data and developing ethical standards for collecting content that emerged in the context of modern social movements, while the research focused more on technological aspects and the use of archival materials to study historical changes. Thus, both papers had a common goal – to emphasise the importance of archives and technologies for modern research, but they had different approaches and focuses. The current study focused on the use of archives to investigate the history of information technology and media, using sophisticated data analysis methods, while Jules focused on ethical issues related to archiving the content of social movements and offered recommendations for solving problems that arose in the process of archiving modern digital materials.

E. Goudarouli *et al.* (2018) focused on the technological, ethical, and organisational aspects of the transition to digital archives, in particular, on the example of the National Archives of Great Britain. The researchers explored issues related to the longevity, access to

digital archives, and ethical issues such as data security and privacy. They noted the need to adapt archives to new conditions and technologies to ensure proper storage and access to archival information. The study was consistent with the current one, which also emphasised the importance of preserving archival materials in the face of technological changes, but this research focused more on specific technical tools and methods for organising digital archives. A common approach was the importance of adapting archives to digital realities, but the current study focused on practical solutions that can be used to implement this process.

K. Pełowska (2020) investigated innovations in archival science, in particular, in the context of technological tools necessary for archivists. The researcher emphasised the importance of applying the latest IT developments for archival affairs and infrastructure changes necessary for storing archival materials. In comparison with the conducted research, which focused more on technological aspects, K. Pełowska mainly focused on infrastructure issues, such as designing archival facilities and laboratories for archivists. Both studies interacted through a shared focus on technology and infrastructure, but the research conducted focused more on technical tools and methods, while K. Pełowska focused more on the architectural aspects of archival activities. C. Gauld (2019) drew attention to current trends in archival science, in particular, to the challenges that archives face in the context of digital transformation. His research focused on global trends in the development of archives and the challenges that arise due to changing technological conditions. The study also addressed these aspects, but focused more on specific technical aspects, such as storing digital data and organising archives in digital format. Common topics were related to the need to adapt archives to new conditions, but C. Gauld focused more on general global trends, while this research focused on specific practical tools and technologies.

In the review by M. Procter (2019) considered archives and information as important tools of social and political structures in history. He emphasised that archives were of great importance for the development of administrative and legal systems of early modern societies. The research contrasted with the current study, which focused on digital archives and the challenges associated with their preservation in the face of technological change. The differences between these studies were the emphasis on the historical context and the role of archives in the social and political sphere by M. Procter, while the conducted research was more focused on the technological development of archival affairs in the modern world.

L. Coyner (2019) explored new areas in archival science, in particular, the challenges facing archivists through digital transformation. The researcher also noted the importance of integrating archival principles into new technologies to ensure effective preservation

of archives. In comparison with the conducted study, which focused on the technical aspects of archival tools, L. Coyner emphasised the importance of preserving the foundations of archival affairs in the new environment. The common feature is the integration of technologies into archival activities, but the current study is more focused on specific technical aspects of this integration. New trends in the standardisation of archival affairs and documentation management were investigated by S. Katuu (2023), who emphasised the need to develop a regulatory framework for archives in the digital age. He stressed the importance of creating legal standards governing the processes of digitisation and preservation of materials, ensuring their reliability and protection. The study also focused on standardising processes in digital archives, but focused more on technical aspects such as digitisation tools, data storage software, and organising archives through interactive interfaces. While S. Katuu mainly focused on the legal aspects of archive standardisation, the research paper focused on technical tools and techniques that ensure effective management of digital archives.

G. Colavizza *et al.* (2021) considered the use of artificial intelligence to automate archival processes, noting that AI can greatly facilitate the management of large amounts of archival information by automating the processes of storing and providing access to materials. This study is closely correlated with the conducted one, since both papers consider the use of the latest technologies to improve archival activities. However, the current study focused not only on the use of AI, but also on other innovative technologies, such as the integration of machine learning for automated analysis of archived data, and the use of specialised software to optimise access to digital archives. Thus, although the emphasis in research was slightly different, both approaches contribute to the development of archival affairs in the context of modern technological advances. Based on the analysis of these papers, it was possible to identify several important aspects that should be focused on to improve the process of digitalisation of archives. First, it is necessary to determine the optimal technical means and platforms for digitising materials that allow ensuring maximum accuracy and maintaining authenticity. Given the importance of cultural heritage for scientific research and national identity, the role of archives in preserving information of cultural and historical value is particularly important. Secondly, it is essential to develop effective strategies for integrating social media and other digital platforms into archival practice, because they can act not only as channels for storing and distributing information, but also as tools for feedback and popularisation of archival materials. Thirdly, digital archives should be designed in such a way as to ensure not only the availability, but also the long-term safety of archival materials. This implies the need to develop standards and protocols for digitising and storing documents in digital format.

Summing up, it can be noted that modern digital technologies, in particular, the digitisation of archival materials, the use of social media and Internet platforms, have significantly changed archival practice, contributing to the improvement of accessibility and preservation of cultural heritage. However, the growing role of digital archives requires further research and development of new tools that would ensure the security, accuracy, and authenticity of digital copies of archives. In turn, the use of social media, virtual platforms, and the latest technologies allows creating new opportunities for interactive access to archives, which is an important stage in the development of archival affairs in the digital age.

Conclusions

The process of digitising archives has become an important step in preserving cultural heritage and ensuring access to materials through digital platforms. The use of scanning technologies and software has created effective databases that have contributed to the development of interdisciplinary approaches to the study of the history of information technology and media. The integration of machine learning allowed for faster and more accurate analysis of archival materials, which made it easier to access rare documents and stimulated scientific research. The study focused on the development of digital platforms that play an important role in preserving the cultural heritage and history of information technology and media. The "Europeana" platform was one of the main examples of successful application of innovative technologies for digitisation of cultural materials. It provides users with numerous research opportunities through interactive data search and visualisation tools, for even greater access to archived materials. This allows for an in-depth study of history and culture through digital archives, which contributes to the transformation of cultural heritage into a digital format. However, it was noted that there was a need to improve interaction with local initiatives to increase access to regional and national archival materials.

The development of Ukrainian analogues of digital platforms, in particular "Diia.Digital education", "Archive of Ukrainian Radio" and "Ukrainian Institute of National Memory". These platforms have great potential, as they provide access to digitised materials that contribute to the preservation of national memory and the development of digital literacy. However, the development of these platforms still needs to be improved, in particular, in terms of multimedia content, accessibility to a wide audience and integration with international digital archives. As a result of the study, a comprehensive analysis of digital platforms for preserving cultural heritage and media history was carried out, in particular, using the example of "Europeana" and its Ukrainian counterparts. The importance of further development of technologies for improving access to archival materials and

integrating local initiatives with global resources was noted, which will deepen interaction between national and international digital archives.

The practical results of the study include recommendations for improving existing digital platforms, in particular, creation of multimedia tools for attracting various user groups and integrating Ukrainian initiatives into international digital networks. An important aspect is the introduction of technologies that will promote inclusivity and accessibility for people with special needs. Recommendations were also proposed for the development of national initiatives, which will increase Ukraine's digital presence at the global level. One of the main limitations of the study was the lack of a sufficient statistical base to evaluate the effectiveness of existing platforms and limited access to some archived resources, which

made it difficult to analyse certain aspects. In addition, to implement the proposed recommendations, it is necessary to consider socio-economic and political factors that may influence the development of digital initiatives. Overall, the study highlighted the importance of continuous development of digital technologies to preserve cultural heritage and national memory. It highlighted the need for further research and improvement of digital conservation practices, and the integration of national initiatives into global digital platforms.

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■ Conflict of Interest

None.

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Сучасні тенденції використання архівів для вивчення історії інформаційних технологій та медіа

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Анотація. Метою дослідження було вивчення функціональних можливостей цифрових платформ, технологій, що використовуються для оцифрування та доступу до архівних матеріалів, а також виявлення проблем і потенціалу для вдосконалення українських платформ у контексті розвитку архівної справи та інтеграції національних ініціатив до міжнародних цифрових архівів. В основу дослідження було покладено аналіз цифрових архівів та ресурсів інтерактивних платформ, таких як «Google Books», «Digital Public Library of America», «Internet Archive», «Europeana», «Archive.org», «HathiTrust», «The British Library Digital Collections». Основна увага була зосереджена на розвитку цифрових платформ, які відіграють важливу роль у збереженні культурної спадщини та історії інформаційних технологій і медіа. Платформа «Europeana» стала одним з головних прикладів успішного застосування інноваційних технологій для оцифрування культурних матеріалів. У дослідженні проаналізовано розвиток українських аналогів цифрових платформ, зокрема, «Дія.цифрова освіта», «Архів Українського радіо» та «Український інститут національної пам'яті». Ці платформи надають доступ до оцифрованих матеріалів, що сприяє збереженню національної пам'яті та розвитку цифрової грамотності. У результаті дослідження було проведено комплексний аналіз цифрових платформ для збереження культурної спадщини та медіаісторії, зокрема, на прикладі «Europeana» та її українських аналогів. Водночас було відзначено, що розвиток цих платформ все ще потребує вдосконалення, зокрема, в частині мультимедійного контенту, доступності для широкої аудиторії та інтеграції з міжнародними цифровими архівами. Наголошувалося на важливості подальшого розвитку технологій для покращення доступу до архівних матеріалів та інтеграції місцевих ініціатив з глобальними ресурсами, що сприятиме поглибленню взаємодії між національними та міжнародними цифровими архівами. Загалом дослідження підкреслило важливість постійного розвитку цифрових технологій для збереження культурної спадщини та національної пам'яті, а також наголосило на необхідності подальших досліджень та вдосконалення практик цифрового збереження, зокрема, інтеграції національних ініціатив у глобальні цифрові платформи.

Ключові слова: управління документами; цифрова трансформація; еволюція ресурсів; зберігання даних; обробка даних; комунікаційні платформи

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