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Article

Digital Transformation of Cultural Heritage: Prospects and Threats

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Abstract

The research investigates the impact of digital transformation on culture, particularly cultural heritage, by examining how preservation, representation, and access are evolving in the context of global and Ukrainian-European digitalization. It aims to analyze how digital technologies reshape heritage practices, highlight the challenges they pose, and propose possible solutions. An assessment of prominent initiatives, such as Europeana, Euromuseum, Twin it! World Digital Library, Doctoral Program in Cultural Heritage, Ark, Museum of Stolen Art, and ResearchUA, illustrates that digital tools not only broaden access to cultural resources but also foster new forms of public participation, multicultural exchange, and collaborative digital creation. In this regard, the Internet emerges as a multifunctional space that serves as a technology, a platform for unity, a channel of communication, and a means of cooperation. Of particular significance is the Museum of Stolen Art project launched in Ukraine in 2023, which stands as a unique model of digital innovation in heritage preservation. Nevertheless, the study identifies pressing challenges accompanying digitalization, including fragmented platforms, unstable formats, unequal access, legal and ethical uncertainties, and funding constraints. Addressing these issues requires understanding digitalization not merely as a technological process but as a socio-cultural phenomenon that fundamentally reshapes cultural memory, identity, and institutional responsibility. The findings of this research thus provide practical value for designing effective strategies, educational initiatives, and institutional practices to advance the preservation, accessibility, and sustainability of cultural heritage in the digital era.

Keywords: *digital archives, digital collections, library electronic resources, virtual reality, access to digital resources*

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Introduction

Digitalization is becoming an important tool for preserving and popularizing cultural heritage, fundamentally changing approaches to its representation, access, and protection (Digital Decade, Policy program, n.d.). The European Union's initiative *"A common European data space for cultural heritage"* (2021) focuses on large-scale digitization of monuments, including those at risk of destruction, and promotes the creation of conditions for the reuse of digital resources in education, tourism, and creative industries (Commission proposes a common European data space for cultural heritage, 2021). The report *"The future of Europe's past"* (2023) emphasizes the importance of digital documentation as a key tool for preserving historical heritage against the backdrop of climate and military threats (The future of Europe's past).

Ukraine is also actively developing digital initiatives in the field of cultural heritage. One striking example is the Ark project (2024-2025), which represents a modern approach to responding to the loss of heritage in the war zone, using mobile scanning, 3D modeling technologies, and the creation of electronic archives (Protecting Ukrainian Culture in a Time of War, n.d.; Preserving Ukraine's literary legacy: Czech Ark project's mission of wartime cultural protection, 2024). In addition, projects for the digital representation of lost heritage, such as the Museum of Stolen Art and the EMuseum (Museum of Stolen Art, n.d.), have gained popularity.

Although digitization offers excellent opportunities for preserving cultural heritage and engaging the public, it is also associated with several challenges: instability of digital formats, legal uncertainties, technical fragmentation of platforms, and inequality in access to the necessary infrastructure (Digital Collections, n.d.; MINERVA: improving the production of digital cultural heritage in Europe, 2023). Thus, digitalization should be viewed not only as a purely technological process but also as a multifaceted socio-cultural phenomenon that rethinks the practices of remembrance, institutional responsibility, and the role of culture in the context of global crises.

This article aims to analyze the key aspects and challenges of the digital transformation of cultural heritage. Emphasis is placed on the study of cases of digital archives, collections, and library resources, as well as on possible prospects for developing digital infrastructure in crises and military conflicts.

Literature review

Over the past 10-15 years, the digital transformation of cultural heritage has become an object of considerable scientific interest. Researchers focus not only on the

technical aspects of digitization, but also on the socio-cultural, institutional, and political changes accompanying this process.

N. B. Thylstrup considers mass digitalization as a new form of memory politics, in which institutions and individuals create new cultural centers in the digital space every day (Thylstrup, 2019). K. Müller's work focuses on institutional and local digitization practices in Europe and India and analyzes the formation of born-digital archives that function within the co-creation framework (Müller, 2021). Explores the transformation of the archive into a complex space for mapping digital presence, where the archive acts as a kind of memory laboratory for the format.

Digital technologies have become key in creating, preserving, and disseminating cultural heritage. Researchers Levin et al. (2019) and Poulopoulos and Wallace emphasize the importance of cloud computing and big data technologies in building modern digital infrastructures (Levin et al., 2019; Poulopoulos & Wallace, 2022). Xia et al. (2024) note that digitization significantly expands access to collections and promotes a better understanding of their value.

Scholars are also actively studying and analyzing the impact of augmented reality technologies, in particular virtual reality (VR) and augmented reality (AR), on changing museum spaces and ways of presenting cultural heritage (Hijazi & Baharin, 2022; Poulopoulos & Wallace, 2022; Wallace et al., 2023). Current research emphasizes that XR (augmented reality) continues to be one of the key areas of digital innovation in museums, as the number of relevant solutions and applications is rapidly increasing. The main goal of XR projects in the cultural sphere since their inception has been to improve the visitor experience, which is achieved through the development of personalized digital content (especially in AR format); creation of virtual environments for easy user navigation; demonstration of inaccessible or hidden objects; reconstruction of historical locations and recreation of cultural heritage that has been lost (Boboc et al., 2022).

In the context of digital societal changes, libraries remain key communication centers providing access to knowledge, cultural heritage, and educational resources. The relationship between society and libraries is interdependent. In the digital era, libraries serve as a guarantor of equal access to information for different social groups, contributing to their educational and cultural development. At the same time, the effectiveness of libraries is determined not only by the number of materials accumulated, but also by the level of their accessibility, relevance, and practical application. The article by Makwana (2023) is devoted to these aspects.

Contemporary research in digital cultural heritage is increasingly focused on mediatization as a key mechanism that transforms the ways of accessing heritage and

the nature of public participation in its preservation and interpretation. Digital media actively engage communities in heritage preservation processes: digitizing cultural artifacts and collections. This process removes territorial and institutional barriers, making archives, monuments, and art objects accessible to a broader audience. Thus, it becomes possible to explore cultural heritage remotely through virtual access (van der Hoeven, 2017; Jin & Liu, 2022).

Thus, as our review of scientific literature shows, we can argue about the revival of interest among scientists in digital cultural heritage issues with an emphasis on such aspects as openness, decentralization, and involvement of various communities in preserving and popularizing heritage. Our review of scientific developments demonstrates that digitalization is a much broader context than a technological process. In fact, it is a multi-vector cultural phenomenon that significantly affects the roles of institutions, experts, and ordinary consumers. The digitization of cultural heritage is a complex process that, by opening wide access to the cultural heritage of human civilization, forms new forms of cultural interaction. At the same time, it demonstrates serious challenges to society: the instability of this format of heritage preservation and infrastructure limitations; ethical and legal issues; detachment from context and digital fragmentation.

Methodology

The methodology of writing the article is based on an analytical vision, as well as on theoretical developments and comparative approaches.

The study of scientific monographs and articles allowed us to form a vision of fundamental approaches to the issues of digitizing cultural heritage from both theoretical and practical points of view.

Comparative analysis allowed us to consider various digital projects related to the digitization of cultural heritage. It allowed us to identify local and global forms of representation. In particular, the "Ark" project deserves special attention. Case analysis: aimed at studying practical examples of digital solutions, including virtual reconstructions, 3D modeling, and AR/VR applications. The discourse analysis allowed a deeper understanding of how digital heritage and related aspects are represented in public, expert, and academic discourses. An interpretive approach was used to analyze digital artifacts' cultural and social significance, considering their role in shaping collective memory, creating identity, and transmitting heritage. A systems analysis was used to summarize the challenges of digitalizing cultural heritage (technological, legal, ethical, and organizational). It allowed us to structure the key

issues and establish interdisciplinary connections. An interdisciplinary approach was the basis of this study, which integrates knowledge of cultural studies, digital humanities, media studies, archival studies, and urban studies for a comprehensive and in-depth analysis of the digital transformation of heritage.

Results

Digitization offers us many prospects: it makes cultural heritage accessible to a broader audience, contributes to its long-term preservation, expands the scope of research and the circle of admirers, opens new education opportunities, and dramatically simplifies research. Digital technologies make it possible to study artifacts that are impossible to access physically in detail or to create fascinating virtual journeys through the time and space of different civilizations.

In 2021, the European Union approved the *"Commission proposes a common European data space for cultural heritage"*, which aims to facilitate the digitization, preservation, and reuse of cultural resources. First, it is about accelerating the digitization of cultural heritage. The European Commission emphasizes accelerating the digitalization of tangible cultural heritage, including monuments, sites, artifacts, and other valuable resources. According to the Recommendations developers, this approach will contribute to their preservation for future generations and create opportunities for reuse in various socially important areas, including education, tourism, and cultural and creative industries. As part of the tasks set, Member States are invited to provide complete digital documentation of all cultural heritage sites under threat of physical degradation and at least half of those of interest to mass tourism by 2030. Margrethe Vestager, Vice President for Europe for the Digital Age, emphasized the importance of digitalizing cultural heritage with specific examples:

The tragic fire at Notre Dame Cathedral in Paris showed the importance of digital preservation of culture, and lockdowns have emphasized the need for virtually accessible cultural heritage. A robust data infrastructure, combined with easy data fusion and exchange, is an essential component of a common European data space for cultural heritage (Commission proposes a common European data space for cultural heritage, 2021).

In general, the initiative to digitize cultural heritage in the EU is part of the large-scale strategy of the European Digital Decade, which aims to develop sustainable digital infrastructure, increase the level of digital skills, and stimulate innovation (Digital Decade – Policy program).

In 2023, the European Commission published the report The future of Europe's past, which analyzes the practical implementation of the Recommendations. The

report emphasizes the importance of cultural heritage as the core of Europe's common history, identity, and values, but much of it is under constant threat. The devastating floods in Valencia, the fires at Notre Dame in Paris, and the Stock Exchange in Copenhagen clearly demonstrate how natural disasters caused by climate change can damage irreplaceable cultural sites. Added to this are the consequences of military conflicts, such as the war in Ukraine, which has revealed the vulnerability of cultural monuments in war zones. Priceless artifacts and monuments can be lost forever. It is also imperative to ensure that future generations have access to this heritage so that they can draw inspiration from the wealth of cultural heritage.

The issue of preserving cultural heritage sites during military conflicts remains one of the most complex and important problems in protecting the world's historical and cultural heritage. During periods of armed confrontation, cultural monuments are under a significant threat of destruction or irreversible loss. The Russian aggression against Ukraine, which began in 2014 and the full-scale invasion on February 24, 2022, has particularly exacerbated this problem for Ukraine. In the context of the war in Ukraine, which is accompanied by large-scale destruction of tangible and intangible cultural heritage, international initiatives aimed at documenting, protecting, and preserving cultural property are of particular importance. One of these innovative programs is the Ukrainian-Czech Ark project, officially presented on December 18, 2024, in Prague. This two-year bilateral project launched its first large-scale mission in 2025 and aims to provide a mobile response to cultural losses in the context of hostilities. The project involves using a specialized armored vehicle, Kovcheg-1, adapted for operation in dangerous areas. The transport platform is equipped with modern restoration equipment and digital technologies, which allow for the rapid preservation of historical artifacts, digitization of book collections, and creation of three-dimensional digital copies of stationary objects, including wall paintings and murals.

These examples already show how important a tool the digitalization of cultural heritage is. Given the pace of development of digital technologies, we have effective methods and opportunities to preserve cultural heritage today. As well as creating conditions for their resilience in times of crises and conflicts (natural disasters, wars, fires, and simply the influence of time, etc.). One such recent example is one of the symbols of European culture - Notre Dame Cathedral. Its restoration using digital scanning and modern reconstruction methods demonstrated the advantages of such approaches and helped restore an important object of architecture and history after a severe fire. Thus, digitalization is both a technical solution and a long-term strategic investment. Understanding the importance of digitalization (at least for today) allows

European countries to protect their cultural heritage, considering various negative factors that can lead to its damage or loss (The Future of Europe's Past, 2023).

Perhaps the most pressing issues in cultural heritage preservation concern its protection and preservation in war and other armed conflicts.

Cultural monuments are often threatened by destruction or loss during armed conflict, which may be irreversible. The Russian aggression against Ukraine, which has been ongoing since 2014, as well as the full-scale invasion that began on February 24, 2022, have significantly exacerbated this problem, putting Ukraine's unique cultural heritage in danger. Therefore, in such circumstances, international initiatives that ensure, to the extent possible, the documentation, protection, and preservation of cultural heritage acquire special importance (Romanenko et al., 2025).

Let us dwell in more detail on one of these initiatives. We are talking about the Czech-Ukrainian project The Ark. It was officially presented in Prague on December 18, 2024. It is a genuinely innovative initiative to preserve cultural heritage in the war zone. The project is designed for two years. It began its first rescue mission in 2025. Its focus is on mobile response to cultural losses. It is a specially armored vehicle, Ark-1. It is equipped to work in conditions of increased danger; it has modern restoration equipment and digital control technologies. This car configuration makes it possible to store historical artifacts quickly, digitize book publications, create three-dimensional copies of fixed architectural objects, and wall paintings (mosaics, frescoes). The project involves two mobile digital stations worth CZK 10 million and CZK 20 million, which are used for digital documentation of old prints and manuscripts and for creating archives of 3D models of damaged or threatened cultural objects. The Ark project is being implemented as a public-private partnership with the participation of the Ministry of Culture of the Czech Republic, Ukrainian state institutions, and the National Library of the Czech Republic. Its goal is to create an operational model of digital response to threats of destruction of cultural heritage and ensure its long-term preservation in digital format (Protecting Ukrainian Culture in a Time of War, n.d.; Preserving Ukraine's literary legacy: Czech Ark project's mission of wartime cultural protection, 2024).

Today, there are several examples of the practical implementation of digital cultural heritage projects in different countries:

- American Memory (Library of Congress, n.d.), and resources from other institutions documenting American cultural heritage. (Digital Collections, n.d.).
- Minerva (Ministerial Network for Valorizing Activities in Digitization) is an intergovernmental platform that includes the ministries of culture of the EU

member states. The consortium's work covers political and technical levels, focusing on coordinating and harmonizing initiatives to digitalize cultural heritage. The project focuses on creating common standards, sharing best practices, and developing common approaches to the digital transformation of the cultural sector within the European space (MINERVA: improving the production of digital cultural heritage in Europe, 2023).

- EMuseum (Ukraine). The specialists are digitizing collections, presenting them in virtual space, and recreating (non-)existing objects in an online format. The project includes immersive exhibitions, online tours, augmented reality, animation, and website development. Among the digitized collections and individual cultural artifacts are collections from the National Museum of History of Ukraine, the Bohdan and Varvara Khanenko National Museum of Art, the Ivan Honchar Museum, the National Art Museum of Ukraine, the National Museum of Kyiv Art Gallery, the National Museum of Decorative Arts of Ukraine, the Treasury of the National Museum of History of Ukraine, the National Reserve Kyiv-Pechersk Lavra, the National Museum of Chornobyl, the Museum of Outstanding Figures of Ukrainian Culture, the Historical and Memorial Museum.
- Museum of Stolen Art (Digital space for preserving and documenting Russia's crimes against Ukrainian culture, Ukraine). The museum offers visitors digital copies of artworks that were stolen, destroyed, or disappeared because of the military aggression of the Russian Federation in Ukraine. Among the exhibits are archaeological artifacts, folk life objects of different ethnic communities of Ukraine, monumental works, fine art, architectural monuments, and memorials (Museum of Stolen Art).

Thus, based on the developments of Ardévol (2005), on her views on the Internet from an anthropological and cultural point of view, there can be considered its possibilities in the context of digitizing cultural heritage:

The Internet as a technology: Modern technologies, such as 3D scanning, virtual and augmented reality, artificial intelligence, and blockchain, offer unique opportunities for documenting and preserving cultural heritage. They can be used to create highly accurate digital models of artifacts that serve as a reliable means of preservation, even if the physical objects are lost.

Examples:
EMuseum

EMuseum is a project in Ukraine that aims to digitize museum collections and organize virtual exhibitions and other cultural and educational events. The goal is to preserve and popularize cultural heritage for everyone to create and understand. Among the projects implemented are the virtual exhibition Silvashi Circles (a CD tour), How We Revived Polina Raiko's World in Augmented Reality, and the first Ukrainian VR project about the devastation of war, War Up Close. Since the beginning of the full-scale invasion, Ukrainian museums have been unable to operate at full capacity, depriving viewers of the opportunity to enjoy all their exhibits. The National Art Museum of Ukraine (NAMU) suffered the same fate, with a large part of its collection being moved to a safe place. However, Ukrainian museums have also become direct targets of this war, which Russia is waging not only against the military and civilians, but also against cultural heritage. To preserve the unique objects of national culture, the EMuseum specialists collaborated with scientists from the National Academy of Arts to select the sculptures of Oleksandr Arkhypenko. They were scanned, and the 3D copies created allow these masterpieces to be displayed in Ukraine and abroad (EMuseum, n.d.).

The Ark Project

The Ark project was officially presented in Prague on December 18, 2024. It is a joint initiative of Ukraine and the Czech Republic. The program's main component is the armored Ark-1 vehicle, designed to operate in difficult and dangerous conditions. It transports specialists, modern restoration equipment, and digital technologies. The project aims to preserve historical books in the affected areas and create digital copies and 3D scans of immovable objects, such as frescoes, that cannot be moved from their current location. Two mobile stations, worth 10 and 20 million kroons respectively, will be used to digitize ancient manuscripts and create three-dimensional models of cultural monuments. The Ark is a public-private initiative aimed at reducing the loss of cultural heritage in times of war. It is being implemented under the leadership of the Czech Ministry of Culture in cooperation with the Ukrainian authorities and the Czech National Library.

The Internet is a new social context, an environment of social unity. Digitization transforms cultural heritage into a world-class resource, promoting intercultural dialogue and social integration. It provides access to knowledge and materials for many communities in different parts of the world.

Examples:

The World Digital Library (WDL, n.d.)

The World Digital Library was founded in 2009 as an initiative of the Library of Congress (n.d.) with the support of UNESCO and contributions from libraries, archives, museums, educational institutions, and international organizations worldwide. The goal is to preserve and disseminate the world's most important cultural objects, providing access to significant historical documents and cultural treasures for research, discovery, and practical use. Books, manuscripts, maps, and other primary sources are presented in their original languages. The project uses over 100 languages, including many lesser-known or endangered ones. Metadata from seven languages is available in the format of downloadable datasets. Among the digital collections of the Library of Congress (n.d.) are the history of American buildings and the development of engineering thought; newspaper chronicles of America; maps of the American Civil War; materials on the history of Austria, Czechoslovakia, Hungary, Germany, the USSR, Poland, the Baltic States, Finland, Spain, Saudi Arabia, Israel, the Persian Gulf States, and others. There is also a collection of cultural artifacts in CD formats: musical instruments (flutes, whistles, etc.); personal photo archives of people in a historical and cultural context; cutlery; jewelry, etc. (Digital Collections, n.d.; Library of Congress, n.d.).

ResearchUA

The library digital platform ResearchUA (2023) aims to develop Ukraine's electronic research infrastructure and create a single digital research space. Its goal is to collect, integrate, optimize, and ensure the presence of Ukrainian scientific and information library resources in global digital communications. This initiative is a digital project of the Vernadsky National Library of Ukraine. The ResearchUA digital library platform aims to develop Ukraine's electronic research infrastructure and create a nationwide digital research environment. Its goal is to accumulate, integrate, and effectively use and implementing the Ukrainian scientific electronic library and information resources into modern international digital communications. The services of the ResearchUA library platform are designed to provide active information support for scientific research in Ukraine: to promote the development of innovative forms of digital scientific communication; to implement modern models of cooperation between scientific libraries and authors of scientific works and other copyright holders; to consolidate national resources and improve access to them in digital format; to ensure the introduction of electronic documents belonging to the cultural heritage of Ukraine into scientific circulation; to develop analytical tools.

The Internet is a tool for creativity, collaboration, and development. The digital environment opens new opportunities for museums, archives, and libraries to interact with researchers, artists, and even a wider audience. Crowdsourcing can serve as an

effective tool for deciphering historical documents or developing educational projects based on digitized data.

Examples:

Doctoral Program in Cultural Heritage

The educational project "Doctoral Program in Cultural Heritage" (n.d.). It focuses on preservation (Safeguarding), research and education (Research & Education); dissemination and actualization (Dissemination & Valorization); and reconnection (Reconnecting). The program is the result of cooperation between leading research universities in Europe (Freie Universität Berlin, Alma Mater Studiorum, Università di Bologna, University College Dublin/An Coláiste Ollscoile Baile Átha Cliath, University of Edinburgh, Helsingin yliopisto/Helsingfors universitet, Uniwersytet Jagielloński w Krakowie, Universiteit Leiden, KU Leuven, Universidad Complutense de Madrid, Université Paris 1 Panthéon-Sorbonne, Universität Zürich), which have joined forces to form a unique alliance called Una Europa. These scientific and educational institutions have become the heart of Europe's educational development for more than a millennium. Today, they train over 500 thousand students and employ almost 100 thousand people. In addition, numerous students are mastering digital learning methods with millions of users. The main goal of Una Europa is to develop common strengths to create a truly European university space - the University of the Future (About, n.d.; Doctoral Program in Cultural Heritage, n.d.).

Europeana

More than 60 million works of art, books, films, and music from thousands of cultural institutions in Europe (museums, libraries, archives) are freely available for the promotion, education, exchange of information, and communication about the cultural heritage of Europe: 36644056 images, 26625968 texts, 1201558 sound recordings, 364755 videos, 8287 3D. The cooperation occurs with thousands of European institutions, including galleries, libraries, archives, and museums, united by a common belief that access to cultural heritage has a transformative power. It opens new opportunities for everyone and contributes to the overall development of society. Thanks to this collaboration in digitizing collections and willingness to share them, this platform has been created, offering a wide range of digital cultural heritages of Europe, accessible to all. The catalog covers materials from over 2000 different institutions representing the richness of European culture. Among the sections presented on Europeana are: migration (the history of the life and activities of famous migrants and the specific culture of this way of life); music (music recordings, sheet

music, musical instruments, musical styles, composers and performers); natural history (study of plants and animals through pictures, texts, sounds); history of periodicals; archaeology; art; fashion; manuscripts; cartography; industrial heritage; sports (Discover Europe's digital cultural heritage, n.d.)

The Internet as a communication channel - digital media opens opportunities for multichannel presentation of cultural heritage through websites, social networks, podcasts, videos, and interactive online exhibitions. It makes it possible to attract new audiences, especially young people, for whom digital space is a natural environment for communication and interaction.

Examples:

Twin it! A pan-European collection of heritage 3D models.

A pan-European collection of 3D models of buildings, landmarks, and objects in Europe allows for virtual exploration of the architectural heritage of European countries. As part of the Twin it! (n.d.) 3D for Europe cultural initiative launched by the European Commission and the Europeana platform, EU member states were invited to select and share at least one symbolic and high-quality 3D model, adding it to the common European cultural heritage data space. Among the proposed exhibits are architectural monuments from Austria, the Royal Cultural and Historical Monuments of the Belgian Institute of Natural Sciences, the Bulgarian Academy of Sciences, the Croatian Institute for Nature Conservation, the Digital Heritage Research Laboratory of the Cyprus University of Technology, the National Gallery of Denmark, and others. In addition to architectural masterpieces, the platform features plastic art from different historical periods, interiors, and memorial artifacts (Twin it! A pan-European collection of heritage 3D models).

Museum of Stolen Art (Ukraine).

The museum began its work in 2023 and presents digital reproductions of artworks stolen, destroyed, or lost because of Russia's war against Ukraine. The beginning of the activity related to the works of Arkhip Kuidzhi, which the Russian occupiers in Mariupol stole. Unlike traditional museums, where it is impossible to exhibit stolen works and reproductions are often perceived as less authentic, our project aims to create the most realistic experience of visiting an exhibition. It is accessible from any device and from anywhere in the world. Les Yakymchuk, co-founder of the charity organization UA First Aid and historian, emphasizes two key advantages of this format. First, it is accessibility. The virtual museum has no physical limitations, so anyone with access to the Internet from a computer or phone can view the exhibition at any time and from location. Secondly, immersive. Instead of simply

reading complex information, the viewer is immersed in an interactive experience. They can see, hear, and even emotionally experience art. It provides a more substantial impact and arouses interest in further independent study of stolen cultural property. It was challenging to convey the project's idea to potential partners, especially museum workers, because nothing like this existed. That is why the team decided to develop a prototype independently and only then engage experts to finalize the starting material jointly. In the future, the organizers plan to expand the Mariupol room by adding new exhibits in cooperation with museum specialists and experts who have digital copies of the works. In addition, the team will work on creating the next rooms dedicated to art stolen by the Russians. It will include exhibits from destroyed Kyiv, Kharkiv, Sumy, Donetsk, Luhansk, Mykolaiv, Kherson, Zaporizhzhia, and Crimea museums. The authors hope that their project will contribute to the process of restitution of cultural heritage through negotiations, as well as the return or compensation for losses incurred by Ukraine after the war (Museum of Stolen Art, n.d.; Sovschak, 2023).

Thus, by combining theoretical analysis and consideration of specific examples of digital initiatives, it has been established that the digitalization of cultural heritage contributes to the preservation of tangible and intangible cultural property and changes approaches to access, interpretation, and participation in cultural processes.

Examination of practical examples of digitalization of cultural heritage demonstrates the following:

- EMuseum and Twin! Reveal the use of 3D modeling, AR/VR, and crowdsourcing for inclusive heritage preservation.
- The World Digital Library (WDL, n.d.), Europeana, the Doctoral Program in Cultural Heritage (unaueropa), and ResearchUA are examples of intercultural communication and open access at the global level.
- The Museum of Stolen Art and the Ark project illustrate the response to the loss of cultural objects in war zones and the adaptation of digital technologies in crisis conditions.

In today's context, digital archives are no longer purely institutional structures emphasizing evidence and recording. They are transforming into multifunctional platforms that provide opportunities for searching, engaging, remixing, and interacting with digital content.

Likewise, library digital resources, digital collections, repositories, databases, and multimedia materials perform an informational and mediating function. Thanks to interactive interfaces, they provide access to cultural heritage and allow its interpretation, citation, and adaptation. As a result, libraries and archives in the digital

era increasingly focus on meeting the user's needs as an active co-creator of knowledge, not just a consumer of information.

In such an environment, our everyday life is gradually intertwined with the archival space, becoming an element of the digital memory economy. Objects created on social media, educational platforms, or cloud services acquire archival status, changing or supplementing traditional ideas about the preservation and significance of cultural heritage.

As seen above, digitalizing cultural heritage creates new perspectives for preservation, access, and community engagement. However, this process involves significant technological and legal challenges and ethical, social, and organizational risks. These factors directly affect the sustainability and authenticity of digital cultural resources.

Digital transformation, while having obvious advantages, faces many challenges. The systematic analysis created a table of challenges that clearly reflects the complexity and interdisciplinary nature of these problems (Table 1).

Table 1. Challenges of digitalization of cultural heritage: key aspects

Challenge	Cause	Consequence
Technological instability and format obsolescence	The intensive development of digital technologies creates risks of loss of data compatibility, the need for frequent content migration between platforms, and the technical depreciation of digital collections.	The risk of losing access to digital collections increases the costs of maintaining their virtual capabilities. The problem of long-term storage and digital preservation
Unequal access to digital resources	Significant disparities in access to digital technologies and the Internet among countries, regions, and communities	The problem of digital inequality and exclusion in the preservation of and access to digital cultural heritage. Exclusion of particular user groups, violation of the principle of accessibility of heritage
Platform fragmentation and lack of standards	Various formats, metadata, and interfaces often accompany the diversity of digital initiatives.	The problem of interoperability between institutions and systems Complicated data exchange, duplication of initiatives
Digitization without considering the context	Digital copies of artifacts often do not reflect the full socio-cultural context of their creation and use	Risk of simplifying multifaceted meanings to simple visual images or data. Simplification, superficial understanding of artifacts, and detachment from socio-cultural significance
Copyright and open access restrictions	Legal restrictions significantly complicate the distribution of digital	Conflict between the desire for openness and the requirements of copyright holders.

	materials, especially those protected by copyright.	Restrictions on open access to collections and reduced audience outreach.
Commercialization of cultural heritage	Some institutions may use digital content for business purposes, putting profit above the public function (e.g., paid access).	Turning heritage into a commodity in the digital space. Transformation of public goods into commercial services, unequal access
Ethical dilemmas of digital reproduction	Creating 3D models or VR simulations of monuments, events, and phenomena can cause controversy over authenticity, manipulation, or cultural sensitivity.	Questions of authenticity and symbolic responsibility. Dissemination of questionable versions of history,
Financial and human resource constraints	Many cultural heritage institutions face insufficient funding and a lack of qualified professionals to implement digital practices systematically.	Organizational weakness in the implementation of digital projects. Possible incompleteness of digital projects, dependence on external partners
Prevalence of official narratives over alternative forms of memory	Digitalization primarily focuses on official archives and collections, while informal or marginalized histories remain in the shadows.	The risk of homogenizing historical memory Ignoring minority voices, loss of diversity in the representation of the past

Source: compiled by: Adane et al., 2019; Rozghon et al., 2024; Shad et al., 2024; Siliutina et al., 2024.

Challenges related to digitalizing cultural heritage are complex and multidimensional, encompassing technical, socio-cultural, ethical, and legal aspects. Understanding the causes and consequences of these challenges is an important prerequisite for creating sustainable strategies for the digital preservation of the cultural heritage of humanity, which will not only promote accessibility but also ensure the authenticity and diversity of cultural heritage, as well as the possibility of its use in education, tourism, creativity, and cultural diplomacy.

To illustrate the challenges and ways to overcome them, the authors offer the following (Table 2).

Table 2. Challenges and opportunities in the digital transformation of cultural heritage

Challenges	Opportunities to overcome
Fragmentation of digital platforms (disparate databases, lack of integration)	Creation of unified repositories and aggregators (Europeana, World Digital Library)
Instability of formats, technology obsolescence	Development of long-term preservation standards (protocols, open formats)
Unequal access to digital resources (digital divide)	Online platforms for a mass audience (remote access, interfaces in many languages) |
Legal barriers (copyright, access restrictions)	Promotion of open access practices, Creative Commons licenses

Ethical risks (representation of communities, privacy)	Crowdsourcing, community participation in projects, and codes of ethics
Funding and project instability	International grants, public-private partnerships (example of the Ark project)

Source: compiled by Siliutina et al., 2024; Kulyniak, 2022.

Thus, digitalization goes beyond a purely technical process, affecting social practices of memory, modes of cultural communication, identity formation, and cultural consumption. Cultural institutions are increasingly becoming co-creation platforms where users are actively involved in representing the past.

However, several key barriers exist, including inequality of access, lack of common standards, legal restrictions, insufficient funding, and ethical challenges. Solving these problems requires joint efforts between institutions, governments, and responsible citizens.

Discussions

Culture has traditionally been associated with the past, including historical artifacts, architectural monuments, works of art, and perceptions of a shared historical past (which can unite and divide communities). However, the modern understanding of culture is much broader. It encompasses the system of meanings, norms, practices, and interactions that shape our identity, behavioral patterns, and types of social connections in everyday life. In the digital era, culture existed in a hybrid environment where the physical world is closely intertwined with the digital world. Technologies play a key role here as drivers of cultural change, influencing communication, organization of cultural practices, and transformation of meaning systems. It leads to cultural globalization, often monoculture (Poulopoulos & Wallace, 2022).

Analyzing mass digitalization as a global cultural and political phenomenon, N. B. Tilstrup offers a conceptual framework beyond the traditional notion of digitization as a purely technical process. Based on a comparative analysis of such initiatives as Google Books, Europeana, and alternative digital archives, the researcher formulates an approach to digital cultural memory archives through the prism of assembly, infrastructure, and infrapolitics concepts. According to the researcher, this process contributes to the emergence of new types of archives that differ in structure and the principles of user interaction with digital artifacts. As a result, mass digitalization transforms the politics of cultural memory and affects our perception of the past and the ways of social interaction in modern society (Thylstrup, 2019).

Ardévol proposed to look at the Internet and its possibilities from an anthropological and cultural perspective, which changes the previously existing

models of social relations, self-identification, and community identification. This approach plays an important role in digitizing cultural heritage, as it ensures the technical preservation of artifacts and contributes to rethinking their role in the digital space. It is where new forms of interaction and perception of cultural values emerge. It opens an opportunity to understand better how digitalization affects the formation of communities' identities, collective memory, and modern ways of transmitting knowledge.

In her research map of the Internet Galaxy, she identified four prominent constellations (Ardévol, 2005) that can be adapted to analyze the digitalization of cultural heritage:

1. Cyberculture is a new cultural model built based on Internet technologies. It contributes to rethinking traditional ways of interacting with cultural heritage in the digital age. Museums, archives, and libraries are now able not only to store exhibits but also to present them in innovative formats, integrating technologies such as virtual reality, 3D modeling, and interactive platforms (Poulopoulos & Wallace, 2022).
2. Cyberculture is a culture that emerges and develops in the Internet environment. Digitalizing cultural heritage opens new forms of exchange and interpretation of cultural heritage. Users become consumers of content and active participants in its creation, discussion, and dissemination, forming communities around cultural artifacts (Vicente & Amaral, 2020).
3. Cyberculture is a cultural product of the Internet. Digitized collections are inherently becoming independent digital cultural products: online exhibitions, virtual tours, and interactive educational resources. These formats allow a global audience to access cultural heritage previously limited by physical localization (Open and reusable digital cultural heritage, 2024).
4. Cyberculture as a form of media. The Internet is a powerful tool for disseminating information about cultural heritage, making it accessible to millions of people regardless of geographic and language barriers. Compared to physical space, created with the help of virtual reality (VR) technologies, cultural heritage is intangible and non-physical. Authentic heritage adapts to digital environments through visual symbols, forming a new perception system. Despite its virtual nature, the sensory experiences that can be obtained in such spaces can be incredibly authentic. Technologies, from the most ancient to modern VR in cyberspace, not only duplicate and enhance reality, but also create opportunities for its

transformation and multidimensional reproduction. In VR-modeled worlds, cultural heritage sites are transformed into dynamic spaces beyond time and geographical limitations. Technology allows users to immerse themselves in complex narratives where past and present intertwine in digital reality. One notable example is the Dunhuang Virtual Tour project, which combines the WeChat mini-app with the Digital Dunhuang database. The project presents a life-size three-dimensional model of the cave, which makes it possible to view the murals in high resolution, without the need to be physically present at the site. As a result, a millennial cultural treasure located in the desert becomes available to millions of users in a virtual format (Jin & Liu, 2022).

G. Giannaki, exploring the evolution of archives and their current digital format, content, and semantic messages, based on the theoretical developments of M. Schenck on Archives 1.0, 2.0, and 3.0, offers her understanding of the concept of archives. The researcher added Archives 0.0 and Archives 4.0. Archives 1.0 refer to the times of Antiquity (pre-archives). Such archives are local and usually centered around a single person or community. Giannaki emphasizes that such archives are difficult to perceive in the modern context. However, they are an important historical source. The Vatican archives are an example of Archives 1.0. They are characterized by global coverage both in space and time. At the same time, they have a certain percentage of losses. The principles of provenance and primordial order are already in place for such archives. Archives 2.0 is already a tool for global production, storage, and dissemination of knowledge. There is a significant increase in archiving volume, primarily due to technological capabilities. The user is also becoming involved in self-documentation. At the same time, archives are no longer just a physical place or object. They are becoming integrated media and communication strategies (Michael & Werner, 2024). Then came the time of the first generation of electronic records, which led to a qualitatively new level of information and changed approaches to archival storage. Archive 3.0 and Archive 4.0 acquired a mixed reality format in the twentieth and twenty-first centuries, turning into complex digital objects. New generation digital complex objects set the direction for the development of the Archive 4.0 paradigm, where archives are no longer places for storing historical evidence. They are transforming into integrated operating environments of modern life, where users play a key role as active creators, curators, and mediators of digital data.

Big data analysis technologies are becoming especially important, updating cultural products and opening new horizons for their more profound understanding. The impact of these changes is also noticeable in digitizing cultural heritage. The notion of culture as a multidimensional and dynamic phenomenon encourages us to

rethink the principles of digital heritage representation: from static fixation of artifacts to creating interactive, contextually rich, and adaptive digital objects. In such a paradigm, digitization becomes not just a technical procedure but a complex infrastructural practice considering constantly changing social, cultural, and technological factors (Wallace et al., 2023). For example, Levin et al. (2019) propose using big data and remote sensing technologies to identify threats to World Heritage sites quickly. World Heritage sites are key elements of the international mechanism for protecting areas of outstanding universal value. However, more than 50 UNESCO sites are listed as in danger of destruction, with almost 40% located in the Middle East. Since 2010 alone, 30 new sites worldwide have been added. Armed conflicts pose the greatest danger to natural and cultural sites. Other significant threats include inefficient management and unauthorized development of territories on a global scale, poaching (especially in Africa), and massive deforestation in tropical regions. Conflicts remain the leading cause of destructive impact despite the diversity of risks. The use of oversized data analysis methods for conflict events and the processing of satellite images, particularly nighttime lighting data, has made it possible to identify areas affected by conflicts in almost real time. According to the researchers, such big data analysis can serve as an effective basis for forming a global, technologically structured early warning system on a global scale. Such a database aims to prevent significant losses of cultural heritage, primarily when destruction or damage becomes irreversible (Levin et al., 2019). It is already apparent that digitalization is fundamentally transforming traditional approaches to the preservation, research, and presentation of museum and cultural objects. The transition from physical exhibits to digital platforms focused on information content not only simplifies access to cultural resources but also significantly increases the level of their preservation. Studies show that high-precision 3D scanning and modeling technologies significantly reduce the risk of damage to original artifacts. At the same time, their life cycle is extended. By scanning the surfaces of paintings and reliefs, such as the Hereford Map of the World or Goya's Black Pictures, as well as analyzing the shape and texture of sculptures and complex objects (Tutankhamun's tomb, the hieroglyphs on his sarcophagus, traces of damage on the sculptures on the facade of San Petronio or in the ancient Romanesque cloisters of Tudela), the data obtained can serve as a basis for research using digital technologies and the creation of physical copies for diverse purposes. It opens the possibility of producing tactile objects for the blind and visually impaired, creating accurate facsimile reproductions, and organizing exhibitions in museums and other cultural spaces (3D scanning for cultural heritage conservation).

Cultural heritage is key in ensuring stability and sustainable development in modern cities, which are actively transforming under technological, climatic, and ideological transformations (Concilio et al., 2019). The problem of mediatization of urban cultural heritage becomes especially important in the context of public involvement in its preservation practices. This aspect is reflected in the UNESCO Recommendation on the Historic Urban Landscape at the international level, which emphasizes the need to involve local communities to preserve cultural heritage. In urban reality, such cooperation becomes even more important because cities intersect communities distinguished by various lifestyles, cultural preferences, and ethnic and religious characteristics (UNESCO Recommendation on the Historic Urban Landscape). Modern digital media technologies open new horizons for presenting cultural heritage through the prism of the experience of communities and communities themselves. Media technologies contribute to creating multidimensional digital narratives about the history of cities, reflecting a wide range of views and experiences. Thanks to this, they not only convey information about urban cultural heritage but also create an integrated environment that stimulates the active participation of citizens in rethinking, preserving, and adapting to the historical and cultural context and integration into current life. This approach organically corresponds to modern principles of sustainable development of cultural memory in the conditions of urbanization (van der Hoeven, 2017).

In recent years, augmented reality (AR) applications have been actively introduced in cultural heritage preservation and promotion. This technology covers various areas, including technical, managerial, communication, and educational. In the context of communication, AR's ability to simultaneously represent the current state of an object (for example, an archaeological monument, artifact, or architectural structure) and its reconstruction in different historical periods is of particular interest. It creates a unique opportunity for researchers to perform a comparative analysis of reconstruction hypotheses and theories. In addition, it provides an opportunity to critically assess their reliability based on available sources and possible interpretations. Such technologies open new horizons for researchers and consumers, allowing them to study previously inaccessible or lost places, such as the Great Synagogue of Erfurt in Germany. An important and empathetic aspect. After all, such technology also allows you to experience historical events with a profound emotional impact. For cultural institutions, integrating such interactive and immersive formats directly on location, as in the case of the Galileo project at the Galileo Museum in Florence, brings significant advantages (Zarutska et al., 2025). It allows for high-quality mediation even in limited spaces, using specialized equipment and, if necessary, involving

moderators. In addition, virtual reality can enhance the attractiveness of a particular place, creating unforgettable experiences for visitors. At the same time, it contributes to the creation of additional sources of income, for example, through ticket sales, the organization of seminars or special events (Le Riche-Maugis, 2025). Having focused on the advantages and opportunities of digitizing cultural heritage, we cannot ignore several problems with this process. In this regard, we have several lively scientific discussions. One of the main problems remains the need to standardize formats and protocols for digitization, which still hinders effective integration and data exchange between different institutions and countries. In addition, long-term storage of digital copies requires the creation of a stable and robust infrastructure. It is also necessary to develop clear policies for managing the data received. It is important to consider the socio-cultural aspects of this process, in particular, compliance with copyright, ethical norms in displaying artifacts, and finding solutions for personalizing people who access cultural heritage (Adane et al., 2019).

Equally relevant is the issue of financing projects related to digitizing cultural heritage and the entire accompanying spectrum (preservation, presentation, etc.). Funding is often limited. Moreover, the implementation of projects requires the involvement of highly qualified specialists. There are also issues regarding copyright and long-term data protection. Due to mass virtualization, cyber threats and cybersecurity issues are also acute (Care, n.d.; Nnenna & Ume, 2015). Particular attention should be paid to the problem of digital inequality, which arises due to the lack of access to digital materials for people without the Internet or the necessary digital skills (Lenstra & Alkalimat, 2012). It is equally important to preserve original objects' authenticity and context when digitizing them (Hanif, 2023).

The digital transformation of culture changes how cultural heritage is preserved and presented and establishes new approaches to its interpretation and accessibility. It is of critical importance in the context of a globalized world heavily influenced by media and technology.

Conclusions

The digital transformation of cultural heritage goes far beyond a purely technological aspect, becoming a complex cultural, social, and political phenomenon. Thanks to the rapid development of digital technologies and the awareness of the role of cultural heritage in society, it is taking on new forms. From static exhibits frozen in time, cultural heritage is acquiring an interactive, multimedia, and personalized sound. Media infrastructures, digital archives, 3D modeling, augmented and virtual reality technologies, and the analysis of large data sets are all already actively used

and offer new models of cultural knowledge transmission. In addition, digital technologies help to overcome the limitations of geography, time, social factors, and language barriers.

Digital resources open much broader access to cultural heritage, creating a platform for interaction that varies from virtual exhibitions to archives formed through crowdsourcing. This transformation process affects not only the accessibility of heritage. It significantly changes its concept, transforming long-standing ideas about authenticity, context, symbolic value, and global connections.

However, digitalization is accompanied by several challenges. Among them: the need to comply with standards, risks of data loss, copyright issues, unequal access to digital resources, and the danger of unification of cultural memory. It requires a comprehensive interdisciplinary approach, involving specialists from different fields and interaction of management structures. Developing effective and balanced strategies for preserving digital heritage must consider technical aspects, cultural diversity, the rights of communities, and ethical principles.

Digital cultural heritage has already gone beyond the usual framework of traditional archiving. It is actively and irreversibly transforming into a dynamic environment for the joint creation of knowledge, developing cultural practices, and forming inclusive memory. Its future depends on integrating the latest technologies in a balanced way with a responsible attitude to local values and humanitarian principles. At the same time, the issue of financial support for projects in the cultural heritage field remains relevant. Also, the threats of destruction of cultural heritage because of wars and armed conflicts further actualize the importance of finding formats for its protection and preservation, both for the present and future generations. Digitization is not a panacea. However, today it is an essential and effective tool for preserving the cultural polyphony of humanity and its presentation and popularization.

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Conflicts of Interest

The authors declare no conflict of interest.

References

[1] About. (n.d.). UnaEuropa. https://www.una-europa.eu/about

[2] Adane, A., Addis, A. C., & Gedamu, G. (2019). Cultural heritage digitization: Challenges and opportunities. International Journal of Computer Applications, 178(33), 1–5. https://doi.org/10.5120/ijca2019919180

[3] Ardévol, E. (2005). Cyberculture: Anthropological perspectives of the internet. Academia.edu. https://www.academia.edu/7527783/Cyberculture_Anthropological_perspectives_of_the_Internet

[4] Boboc, R., Băutu, E., Florin, G., Popovici, N., & Popovici, D. M. (2022). Augmented reality in cultural heritage: An overview of the last decade of applications. Applied Sciences, 12(19), 9859. https://doi.org/10.3390/app12199859

[5] Care. (n.d.). Library of Congress. https://www.loc.gov/preservation/care/scan.html

[6] Concilio, G., Li, C., Rausell-Köster, P., & Tosoni, I. (2018). Cities as enablers of innovation: The enabling role of design. In G. Concilio & I. Tosoni (Eds.), Innovation capacity and the city (pp. 43–60). Springer. https://doi.org/10.1007/978-3-030-00123-0_3

[7] Digital collections. (n.d.). Library of Congress. https://www.loc.gov/collections/

[8] Digital Decade – Policy program. (n.d.). European Commission. https://digital-strategy.ec.europa.eu/en/policies/digital-decade-policy-programme

[9] Discover Europe's digital cultural heritage. (n.d.). Europeana. https://www.europeana.eu/en

[10] Doctoral program in cultural heritage. (n.d.). UnaEuropa. https://www.una-europa.eu/study/una-her-doc/heritage-and-the-digitization-of-society

[11] EMuseum. (n.d.). https://emuseum.com.ua/

[12] Hanif, S. (2023). The aspects of authenticity in digitalizing cultural heritage: A drifting paradigm. In 2023 International Conference on Sustaining Heritage: Innovative and Digital Approaches (ICSH) (pp. 39–44). IEEE. https://doi.org/10.1109/ICSH57060.2023.10482829

[13] Hijazi, A. N., & Baharin, A. H. A. (2022). The effectiveness of digital technologies for the visitor's experience in digital museums: A systematic literature review from the last two decades. International Journal of Interactive Mobile Technologies, 16(16), 142–159. https://doi.org/10.3991/ijim.v16i16.31811

[14] Jin, P., & Liu, Y. (2022). Fluid space: Digitization of cultural heritage and its media dissemination. Telematics and Informatics Reports, 8, 100022. https://doi.org/10.1016/j.teler.2022.100022

[15] Kulyniak, M. (2022). Digital cultural heritage is a phenomenon of digital culture. Cultural Almanac, 3, 218–227. https://doi.org/10.31392/cult.alm.2022.3.28

[16] Le Riche-Maugis, A. (2025, June 26). XR in cultural heritage: AR, MR, and VR explained. Europeana Pro. https://pro.europeana.eu/post/xr-in-cultural-heritage-ar-mr-and-vr-explained

[17] Lenstra, N., & Alkalimat, A. (2012). Networked cultural heritage and socio-digital inequalities: A case study in an African-American community. In iConference '12 (pp. 160–167). ACM. https://doi.org/10.1145/2132176.213219

[18] Levin, N., Saleem, A., Crandall, D., & Kark, S. (2019). World heritage in danger: Big data and remote sensing can help protect sites in conflict zones. Global Environmental Change, 55, 97–104. https://doi.org/10.1016/j.gloenvcha.2019.02.001

[19] Library of Congress. (n.d.). https://www.loc.gov/

[20] Makwana, J. (2023). Electronic resources: A powerful source for libraries in the modern age. In M. K. Yadav, S. N. Markan, N. Garg, & A. Jaitley (Eds.), Emerging research ideology (pp. 1–26). CIRS Publication. https://www.researchgate.net/publication/376721698

[21] Michael, H., & Werner, V. (2024). Digital press archives for media and communication history research: From reading rooms to virtual research environments. Studies in Communication Sciences, 24(3), 285–301. https://doi.org/10.24434/j.scoms.2024.03.4050

[22] MINERVA: Improving the production of digital cultural heritage in Europe. (2023). https://www.archimuse.com/publishing/ichim03/126P.pdf

[23] Müller, K. (2021). Digital archives and collections: Creating online access to cultural heritage. De Gruyter. https://doi.org/10.1515/9781800731950

[24] Museum of Stolen Art. (n.d.). https://www.museumofstolen.art/

[25] Nnenna, O. B., & Ume, L. E. (2015). Digitization of library resources in academic libraries: Challenges and implications. Journal of Mobile Computing & Application (IOSR-JMCA), 2(2), 35–40. https://doi.org/10.12720/jiii.2.2.136-141

[26] Poulopoulos, V., & Wallace, M. (2022). Digital technologies and the role of data in cultural heritage: The past, the present, and the future. Big Data and Cognitive Computing, 6(3), 73. https://doi.org/10.3390/bdcc6030073

[27] Preserving Ukraine's literary legacy: The Czech Ark project's mission of wartime cultural protection. (2024, February 10). We are Ukraine. https://www.weareukraine.info/preserving-ukraines-literary-legacy-czech-ark-projects-mission-of-war-time-cultural-protection/

[28] Protecting Ukrainian culture in a time of war. (n.d.). Ark for Ukraine. https://www.arkforukraine.org/

[29] ResearchUA – Library digital platform for research support. (2023). National Library of Ukraine named after Vernadsky. http://www.nbuv.gov.ua/node/6345

[30] Romanenko, K., Rieznikov, S., Khvatova, O., Kovalchuk, O., & Romanenko, M. (2025). The Intersection of Spirituality and Artificial Intelligence: Psychological Dimensions of Educational Leadership and Management. International Journal on Culture, History, and Religion, 7(SI1), 372–391. https://doi.org/10.63931/ijchr.v7iSI1.227

[31] Rosales, R. J., Cusi, M., & Reyes, R. J. (2025). Christ as Tahanan: Re-appropriating Christ in the Context of Urban Street Dwellers. International Journal on Culture, History, and Religion, 6(2), 60–65. https://doi.org/10.63931/ijchr.v6i2.44

[32] Rozghon, O., Davydova, I., Oliukha, V., & Shepeliuk, V. (2024). Problems of digitization and use of digitized works by museums from the position of German and Ukrainian copyright law. Science and Innovation, 20(1), 98–130. https://doi.org/10.15407/scine20.01.098

[33] Shad, R., Egon, A., & Potter, K. (2024). Ethical and legal issues surrounding the digitization of culturally sensitive archaeological materials. EasyChair Preprint, 14264. https://easychair.org/publications/preprint/CmnD

[34] Siliutina, I., Tytar, O., Barbash, M., Petrenko, N., & Yepyk, L. (2024). Cultural preservation and digital heritage: Challenges and opportunities. Revista Amazonia Investiga, 13(75), 262–273. https://doi.org/10.34069/AI/2024.75.03.22

[35] Sovschak, A. (2023, October 26). A virtual Museum of Stolen Art has been created in Ukraine—Ukrainian Week. https://tyzhden.ua/v-ukraini-stvoryly-virtualnyj-muzej-vkradenoho-mystetstva/

[36] The future of Europe's past. (2023). Publications Office of the European Union. https://op.europa.eu/en/publication-detail/-/publication/8d2435d7-31fe-11f0-8a44-01aa75ed71a1

[37] Thylstrup, N. B. (2019). The politics of mass digitization. MIT Press. https://doi.org/10.7551/mitpress/11404.001.0001

[38] Twin it! (n.d.). A pan-European collection of heritage 3D models. Europeana. https://www.europeana.eu/en/galleries/15694-twin-it-a-pan-european-collection-of-heritage-3-d-models

[39] UNESCO. (n.d.). UNESCO recommendation on the historic urban landscape. World Heritage Convention. https://whc.unesco.org/en/hul/

[40] van der Hoeven, A. (2017). The mediatization of urban cultural heritage: Participatory approaches to narrating the urban past. In O. Driessens, G. Bolin, A. Hepp, & S. Hjarvard (Eds.), Dynamics of mediatization: Institutional change

and everyday transformations in a digital age (pp. 297–312). Palgrave Macmillan. https://doi.org/10.1007/978-3-319-62983-4_14

[41] Vicente, P. N., & Amaral, I. A. (2020). Cyberculture. In D. M. Haridakis, M. C. Shelley, & B. S. Marshall (Eds.), The SAGE International Encyclopedia of Mass Media and Society (pp. 1–5). SAGE. https://doi.org/10.4135/9781483375519.n113

[42] Wallace, M., Poulopoulos, V., Antoniou, A., & Lopez-Nores, M. (2023). An overview of big data analytics for cultural heritage. Big Data and Cognitive Computing, 7(1), 14. https://doi.org/10.3390/bdcc7010014

[43] World Digital Library. (n.d.). Library of Congress. https://www.loc.gov/item/lcwaN0018836/

[44] Xia, Q., Wang, Q., & Xue, J. (2024). The process of museum digitization technology. In SHS Web of Conferences: International Conference on Educational Development and Social Sciences (EDSS 2024) (Vol. 190). EDP Sciences. https://doi.org/10.1051/shsconf/202419003015

[45] Zarutska, O., Sydorenko, I., Nebesnyk, I., Pylyp, R., & Diachenko, A. (2025). Development of Art Forms in the Contemporary Era: New Platforms and Creative Approaches. International Journal on Culture, History, and Religion, 7(SI1), 35–51. https://doi.org/10.63931/ijchr.v7iSI1.101