

Digital Transformation of Cultural Preservation: Protecting Ukraine's Heritage Under Military Threats

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ABSTRACT

The purpose of this study is to analyse cultural initiatives aimed at preserving Ukraine's cultural heritage in the context of armed conflict in the period 2022 - 2025, with a particular focus on projects to digitise cultural objects that are currently under constant threat. The research is based on international legal acts that regulate the protection of cultural heritage in conditions of armed conflict and establish modern mechanisms for digitising cultural heritage. A systematic review method is used, analysing 15 peer-reviewed publications and case studies containing experience in digitising and protecting cultural heritage sites. The results of the study demonstrate the important role of transforming approaches to cultural heritage preservation, taking into account digitisation and the development of 3D models of artefacts ("ICOM4Ukraine", "Ukraine is Here", "Memory of the World" and "SKEIRON" projects). In conditions of economic instability, such initiatives are only possible within the framework of international cooperation in the field of compliance with humanitarian law and conventional norms. The study confirms that military actions pose a double threat to cultural heritage: the physical destruction of tangible objects and the systematic destruction of intangible cultural identity lead to the degradation of the cultural space as a whole - the loss of significant monuments, the severing of communication links and the weakening of intercultural exchange.

Keywords: Ukraine; UNESCO; Cultural Heritage Preservation; VR Museum; Digital Heritage.

INTRODUCTION

Cultural heritage is one of the most important components of national identity and collective memory, ensuring the continuity of a nation's historical development. Preserving cultural heritage is of strategic importance for any state, as the level of protection of spiritual values correlates with the level of humanitarian development and civilisational maturity of a people. The escalation of the military conflict in Ukraine in 2022-2025 has threatened an unprecedented number of Ukraine's cultural heritage sites. Since the start of the full-scale invasion, there have been numerous cases of destruction of museums, historic buildings, temples, monuments and other cultural sites. On 27 February 2022, as a result of the Russian offensive, the Ivankiv Historical and Local History Museum (Ivankiv village, Kyiv region), which housed unique works by the outstanding Ukrainian folk artist Maria Prymachenko, "burned to the ground" (Schneider, 2022). Along with the building, a significant part of the collection of works by Prymachenko, an artist whose work is a great asset to Ukrainian culture, was lost.

The occupation has been accompanied by systematic looting of Ukrainian museums. According to official data from the Ukrainian authorities, the occupiers have seized approximately 1.7 million cultural artefacts (museum exhibits, archival materials, library collections) from the temporarily occupied territories. In particular, 34,872 museum objects were stolen from 6 museum institutions in 5 de-occupied regions of Ukraine, namely: "Municipal institution Balakliya Museum [...] of Kharkiv Oblast [...]; Snihuriv Historical and Local Lore Museum of Mykolaiv Region [...]"; Municipal institution [...] "Museum and Exhibition Center 'Trostianetsky' of Sumy region [...]"; Velyka Oleksandrivka Folk History and Local Lore Museum of Kherson Oblast", etc. (UNN, 2024). "During their retreat in the fall of 2022, Russian forces stole around 15 000 archaeological finds (Scythian gold, antique icons, items from the Cossack era) from the Kherson Regional Museum, the Kherson Art Museum, and the St. Catherine's Cathedral" (Gettleman & Chubko, 2022; Mukhina, 2025). In total, more than 33,000 works of art and artefacts were stolen from museums in the Kherson region before the city was liberated in November 2022. After de-occupation in November 2022, the Kherson Art Museum began working with international partners to track the fate of its collections. As of April 2023, museum staff confirmed that at least 121 stolen works from their collection are in occupied Crimea: these paintings were spotted in photographs of an "exhibition" at the Central Museum of Tavrida (Simferopol), where the Russians organised a display of works looted in Kherson (Staff, 2024). Exhibits from the Berdiansk Art Museum named after I. Brodsky, including paintings by Aivazovsky and Benois, were completely removed (UNESCO, 2023 b, 13). After the capture of Mariupol in May 2022, the occupying "administration" organised the removal of the most valuable exhibits from Mariupol's museums. Among them were three paintings by Mariupol native Arkhip Kuindzhi and a work by Ivan Aivazovsky, as well as a unique handwritten Torah scroll and an antique Gospel from 1811 (Sauer, 2022). The Russians took stone Polovtsian statues from the 11th–12th centuries from the Mariupol Museum of Local History (Staff, 2024). In Melitopol (Zaporizhzhia region), the Russians stole a unique collection of Scythian gold from the local museum back in the spring of 2022, including the famous Scythian gold comb. This incident was widely reported in the Western press as one of the largest museum robberies since World War II (Gettleman & Chubko, 2022). All of the above figures testify to the scale of the humanitarian and cultural catastrophe accompanying the hostilities and point to the need to create a unified digital archive.

Armed conflicts not only cause physical destruction of cultural objects, but also lead to the degradation of cultural space in general – the loss of meaningful landmarks, the breakdown of communication links, and the weakening of intercultural exchange. In such conditions, cultural heritage items currently located in Ukraine take on particular importance. An important initiative for preservation and promotion is the scanning and digitisation of artefacts to create a common digital archive and document cultural heritage. In conditions of economic instability, such initiatives are only possible within the framework of international cooperation in the field of compliance with humanitarian law and conventional norms aimed at protecting cultural values. Therefore, it is important to examine the effectiveness of international legal instruments and the implementation of digital technologies for the protection and preservation of Ukraine's cultural heritage during armed conflict, as well as to assess their role in strengthening national resilience and cultural recovery.

LITERATURE REVIEW

The issue of cultural heritage preservation has become increasingly relevant over the past five years due to the escalation of military conflicts in Europe. In particular, the problem of protecting cultural heritage sites is being studied in the context of the formation of new political strategies (Shaheen, 2023; Ruiz & Nilsson, 2023), the revision of geopolitical (Baspehliyan & Wedderburn, 2024; Saunders, 2024), historical (Kosnáč & Pala, 2024) and religious (Dias, 2022; Cuno & Weiss, 2022; Staff, 2024) transformations, analysis of new strategies of warfare with an emphasis on the introduction of innovative digital technologies (Goncharuk, 2024). Interdisciplinary links allow for a more thorough examination of the socio-economic and political nature of activities aimed at restoring and preserving cultural heritage. S. Shaheen's concept of strategic culture (2023) is significant for this research, as the author examines the impact of international cooperation on the formation of strategic culture and the preservation of Ukraine's cultural code. He notes that "this interplay of different European cultures at strategic level in close proximity has some important lessons to heed for other states, especially the nuclear dyad of South Asia: India and Pakistan" (Shaheen, 2023, 247). Despite frequent references to Ukraine as an illustrative example, the studies lack a systematic empirical analysis of the losses of Ukrainian cultural heritage based on analytical reports and the current regulatory framework.

The growing amount of literature devoted to digitalisation issues indicates the relevance and importance of digitisation, virtual reconstruction and online archiving of cultural heritage objects during periods of military aggression (Schneider, 2022; Shaheen, 2023; Chelyak, 2024). However, most of these research studies ignore the problematic issues of organising such initiatives. The cumulative effects of prolonged shelling, targeted

destruction, looting, forced displacement of artefacts and institutional disintegration, cybersecurity risks and uneven distribution of technological resources, power cuts are either marginalised or completely ignored. As a result, current scientific research does not provide a solid analytical basis for developing evidence-based policies for the preservation of cultural heritage in conditions of armed aggression. This techno-optimistic bias undermines the analytical credibility of such research and creates the risk of policy recommendations that are detached from the realities of war. It is therefore important to pay attention to the normative framework that regulates contemporary cultural heritage preservation initiatives in wartime, as well as to examine real-life examples of such initiatives).

International Legal Protection of Cultural Property

The prolonged military operation prompted the international community to condemn Russian aggression, which violates international law, as regulated in particular by the 1954 Hague "Convention for the Protection of Cultural Property in the Event of Armed Conflict" and its two protocols (1954 and 1999). This Convention requires participating states to protect cultural property during wartime. The first (Hague) Protocol of 1954 mainly concerns the prevention of the removal and looting of cultural property from occupied territories. According to this Protocol, each participating state undertakes to prevent the removal of cultural property from the territory it has occupied during an armed conflict. If, contrary to this, any property has been removed, states are obliged to take it under their protection and, after the end of hostilities, return it to the legitimate authorities of the territory from which it originated (UNESCO, 1954). In addition, the Protocol explicitly states that such valuables can never be retained as war reparations (i.e. trophies). In fact, this document establishes an international legal norm for the mandatory return of cultural objects looted during war. Currently, the provisions of the First Protocol are relevant to the situation in the occupied territories of Ukraine.

The Second Protocol to the Hague Convention (1999) was introduced to improve the provisions of 1954 in light of the experience of armed conflicts at the end of the 20th century. It provides for a new category – "enhanced protection" – for objects of exceptional importance to humanity, which are specially protected by national legislation and are not used for military purposes (UNESCO, 1999). The state may submit such objects (e.g., outstanding shrines or monuments) to the Committee for the Protection of Cultural Property for inclusion in the List of Objects under Enhanced Protection. During the current war, Ukraine has initiated the provision of enhanced protection for a number of sites. In particular, in March 2022, UNESCO convened an extraordinary meeting of the Committee to consider the issue of Ukrainian monuments. The condition for such protection is the obligation of the parties not to use the site for military purposes and not to damage it, even in case of military necessity (UNESCO, 2023 a). The Second Protocol of 1999 also clearly criminalises serious violations of cultural property. According to Article 15 of this document, intentional acts committed in violation of the Convention or the Protocol, such as armed attacks on cultural heritage sites, illegal appropriation or mass destruction of such properties, as well as any acts involving theft, looting or vandalism of cultural heritage, are recognised as criminal offences at the international level (Second Protocol, 1999). It is important to note that such serious violations include not only direct attacks on monuments, but also looting and theft of cultural property during conflict, which directly relates to cases of mass theft of Ukrainian museum collections by the occupying forces of the Russian Federation.

The Geneva Conventions of 1949 and Additional Protocol I of 1977 prohibit attacks on civilian objects, including cultural ones. Article 53 of Protocol I (1977) expressly prohibits: "to commit any acts of hostility directed against the historic monuments, works of art or places of worship which constitute the cultural or spiritual heritage of peoples," and also prohibits the use of such objects for military purposes and making them the object of reprisals. A similar provision is contained in Article 16 of Additional Protocol II of 1977 (relating to internal conflicts) (ICRC, 1977). Accordingly, these provisions are fully applicable to the international armed conflict in Ukraine: both Ukraine and the Russian Federation are parties to these Protocols. Thus, even outside the framework of the 1954 Convention, Russian troops are obliged not to shell monuments and not to use them for military purposes. Such actions fall squarely within the definition of war crimes under the First Protocol of 1954 (illegal removal of cultural property from occupied territories) and the Second Protocol of 1999 (looting and appropriation of cultural property during conflict), as well as general rules prohibiting looting. In the context of contemporary international humanitarian law, these provisions are also confirmed within the framework of customary international law.

Based on the foregoing analysis of regulatoare and legal governing the protection of cultural heritage in wartime, it is appropriate to assess the current state of Ukraine's cultural policy regarding the preservation of rescued artefacts and the restoration of cultural infrastructure. In cooperation with international partners, the state is developing programmes for digitization, establishing mechanisms for registration of damaged cultural objects, and implementing cultural and diplomatic initiatives aimed at integration into the European cultural

space. The strategic priorities of state cultural policy are articulated in the Law of Ukraine “On the Protection of Cultural Heritage” (2005) and the Resolution of the Cabinet of Ministers of Ukraine “On the Approval of the Strategy for the Development of Culture in Ukraine for the Period until 2030 and the Approval of the Operational Plan of Measures for its Implementation in 2025-2027” (2025). At the same time, the practical implementation implementation of these cultural initiatives is significantly constained, and in some cases rendered unfeasible, by the ongoing escalation of the military conflict. It is therefore important to examine existing practices for preserving Ukraine’s cultural heritage and to outline recommendations for further work, taking into account the results obtained.

METHODOLOGY

Research Design

The study uses a systematic approach to assess the experience of preserving Ukraine’s cultural heritage, taking into account the circumstances of the escalating military conflict. Methodologically, the research uses an interdisciplinary approach that combines legal analysis, institutional assessment, and evaluation of digital heritage practices based on specific cases, allowing for a contextualised understanding of cultural heritage protection in wartime. The methodological basis of the study includes a review of the regulatory framework, analytical literature on the preservation and protection of cultural heritage, as well as technological reviews on digitisation and the development of 3D models. A comprehensive systematic review of 15 peer-reviewed publications and case studies covered theoretical and practical achievements as shown in [Table 1](#). These sources were selected using a comprehensive search approach in Scopus, Web of Science, and Google Scholar, published between 2022 and 2025, reflecting the current state and relevance of the development of this issue. The case studies included address issues of digitisation and archiving of cultural heritage objects in Ukraine. To ensure quality and relevance, only peer-reviewed journal articles, conference proceedings, and in-depth thematic studies were used. The research results were supported by thematic studies on the establishment of new technologies and their effectiveness.

Table 1. Selection Criteria for Reviewed Literature

Criterion	Description
Time-frame	Literature published over the last three years, reflecting the relevance and urgency of addressing the issues outlined.
Relevance	Focus on initiatives to protect cultural heritage in wartime and digitise Ukraine’s preserved artefacts.
Peer-reviewed Status	The study reviews peer-reviewed articles and thematic reviews from authoritative online resources.
Geographic Scope	Studies from different geographical regions are included to analyse the global state of development of this issue.
Technological Focus	Focus on research that examines cultural initiatives to digitise artefacts and create electronic registers of damaged and preserved cultural sites in Ukraine.

The article analyses the significance of the documents of the “Protocol for the Protection of Cultural Property in the Event of Armed Conflict” (The Hague, 14 May 1954), the “Convention Concerning the Protection of the World Cultural and Natural Heritage” (16 November 1972), and the Law of Ukraine “On the Protection of Cultural Heritage” (2005). Of particular importance is scientific research that provides theoretical knowledge about cultural property listed in the State Register of Immovable Monuments (2025) that is currently damaged, illegally removed or completely destroyed.

Framework for Analysis

The method of critical analysis of sources was used to search for and systematise scientific publications related to the topic of the article. Semiotic and axiological methods contributed to a comprehensive approach to the consideration of individual international projects aimed at preserving the historical and cultural heritage of Ukraine. The analytical framework is organised into three main stages: (I) international cultural initiatives for the preservation of Ukrainian cultural heritage, (II) state cultural initiatives for the preservation of artefacts under constant attack, and (III) systematic digital transformation of institutions that preserve cultural heritage. These stages of research ensure a deep understanding of how digitisation methods comply with the principles of preserving cultural, historical and material heritage.

Step I: International Cultural and Diplomatic Initiatives to Preserve Ukrainian Cultural Heritage

An analytical review of international cultural and diplomatic initiatives for the preservation of cultural heritage is being conducted with the aim of discussing problematic issues aimed at integration into the European cultural space ("Horizon Europe", "Memory of the World", "ICOM4Ukraine"). In conditions of economic instability, such initiatives are only possible within the framework of international cooperation in the field of compliance with humanitarian law and conventional norms aimed at protecting cultural values. The research is based on a review of current experience in organising risk management measures in the EU ("Safeguarding Cultural Heritage from Natural and Man-Made Disasters : a Comparative Analysis of Risk Management in the EU"), conducted by the European Commission to illustrate current knowledge on the protection of cultural heritage in the context of escalating military conflicts (European Commission, 2018). Particular attention is paid to UNESCO's international activities in the search for a mechanism for independent data assessment in Ukraine, including the analysis of satellite images, in accordance with the provisions of the Hague "Convention for the Protection of Cultural Property in the Event of Armed Conflict" (1954).

Step II: State Cultural Initiatives for the Preservation of Artefacts under Constant Shelling

The second stage of the methodology involves researching state cultural initiatives. A comparative analysis of case studies is conducted to analyse cultural heritage preservation issues with a view to discussing problematic issues caused by the escalation of military conflict in modern Ukraine. The facts of destruction and looting of museum institutions since the beginning of the military conflict are considered. The condition of some museums in Ukraine in the war-torn territories is described. In the course of researching this topic, an attempt was made to address the following tasks: to identify the most resonant examples of looting and destruction of museum heritage sites by the occupiers; to analyse these examples by collecting statistical data, reviewing scientific articles and journalistic assessments; to consider the public response to the destruction and looting of museums in war-torn territories. The research provides an empirical overview of the damage caused to cultural property by cross-checking reports of incidents from several reliable sources obtained through open source monitoring, field visits and internal monitoring data from representatives of religious organisations and press services.

Step III: Systematic Digital Transformation of Institutions that Preserve Cultural Heritage

The third stage of the methodology combines the conclusions of the previous stages to assess the systematic nature of the digital transformation experience of institutions that preserve cultural heritage. This method involves analysing specific examples in which digitisation has been used to create three-dimensional objects from analogue artefacts and to form virtual treasures of Ukrainian museums with online access, expert commentary, 3D visualisation and multimedia technologies. Literature on digitisation and VR technologies is used to explore ways in which 3D modelling methods can ensure both structural integrity and historical preservation. The study assesses the role that digitisation can play in preserving cultural heritage.

A systematic approach allows for a comprehensive analysis of how contemporary cultural heritage preservation initiatives are regulated by legal and regulatory documents and contribute to the preservation of cultural monuments, while enhancing their historical and artistic value.

FINDINGS

International Cultural Initiatives to Preserve Ukrainian Cultural Heritage

At the beginning of full-scale aggression (since February 2022), UNESCO stepped up its monitoring of the escalating military conflict and launched coordinated actions to protect cultural heritage. In particular, in cooperation with the UN (UNITAR/UNOSAT), satellite surveillance systems were set up to monitor and verify damage to cultural sites in Ukraine on a daily basis (UNESCO, 2023 b). The UNESCO website systematically publishes (with appropriate updates) a list of confirmed destroyed or damaged sites by region. In particular, "As of 10 December 2025, there are 514 cultural sites that have been verified as damaged (152 religious sites, 268 buildings of historical and/or artistic interest, 38 museums, 33 monuments, 19 libraries, 3 archaeological sites, 1 archive)" (Larcan, 2025). Such monitoring not only records war crimes against culture, but also helps to plan further restoration. One of UNESCO's landmark decisions was to add the "Historic Centre of Odessa" to the List of World Heritage in Danger in January 2023 (UNESCO, 2023 b, 3). This step was taken on an exceptional basis, given the immediate military threat in Odessa and the destruction of a number of monuments in the city. The status of an endangered site opens up opportunities to attract additional resources for the protection and conservation of monuments, and is also a political signal about the need to stop the attacks.

Over the past three years, numerous international cultural initiatives have been implemented with the aim of preserving Ukrainian cultural heritage. The most ambitious projects have been organised with the support of the

following international organisations

- 1) "The International Alliance for the Protection of Heritage in Conflict Areas" ("ALIPH" Foundation) provides grants to Ukrainian museums and nature reserves for the purchase of materials for conservation, firefighting, digitisation of collections, etc. (ALIPH, 2022). According to the text of the "Memorandum on the Establishment of the Ukrainian Cultural Heritage Fund", the Fund serves as a key mechanism for coordinating and managing international financial assistance aimed at preserving and restoring Ukraine's cultural heritage, supporting digital transformation in the heritage sector, and promoting the development of the professional community (MCSC, 2025);
- 2) "International Council of Museums" (ICOM) and "International Council on Monuments and Sites" (ICOMOS) (exchange of information on stolen items). In particular, the ICOM project to assist Ukrainian museum institutions, "Ukrainian Museums in Danger: A Three-Step Plan to Address the Problem through Knowledge, Action and Visibility" (2023-2024), focused on the digital preservation of collections. As part of this project, many small museums received digitisation software and specialised restoration equipment (ICOM, 2023);
- 3) "Blue Shield" – an international committee for the preservation of culture, which coordinates museum experts, archivists, librarians and other specialists to provide assistance in conflict zones. In particular, with funding from the Federal Ministry of Housing, Urban Development and Construction, Blue Shield Germany is implementing a platform for the reconstruction of Ukraine, providing conceptual recommendations for the restoration of Ukraine (Blue Shield, 2024);
- 4) Interpol (cooperates with Ukrainian law enforcement agencies to track the movement of art objects on the black market).

Most of these international initiatives are aimed at addressing issues related to monitoring stolen cultural heritage objects and digitising artefacts located in Ukraine. Digitisation under UNESCO's "Memory of the World" Programme helps to attract additional financial mechanisms for the preservation of cultural (UNESCO, n.d.). The "Memory of the World" International Register lists five items of Ukrainian cultural heritage: Collection of Jewish Musical Folklore (1912-1947), Radzwill's Archives and Niasvish (Nieśwież) Library Collection (2009), Documentary Heritage Related to the Chernobyl Accident (2017), The Act of the Union of Lublin document (2017), Documentary Heritage of Babyn Yar (2023) (UNESCO, n.d.). These documents have been recognised by the International Advisory Committee and approved by the Director-General of UNESCO as meeting the criteria of global significance.

One of the most ambitious initiatives in this field in Europe is the EU Cultural Heritage Cloud Platform, funded under "Horizon Europe". During the period of full-scale aggression (in December 2023), a Horizon Europe office was opened in Ukraine with the task of actively promoting EU funding opportunities, providing technical support to Ukrainian researchers and innovators, and strengthening networks between Ukrainian and European institutions. As a result, as of 3 January 2026, there are 490 grant agreements that have been implemented with the support of "Horizon Europe" (Cordis, n.d.).

The German government has joined the initiative to digitise Ukraine's cultural heritage by introducing a series of cultural events. According to the German government, there are over 400 museums and 3,000 cultural sites in Ukraine, including seven UNESCO World Heritage Sites (Cuno & Weiss, 2022). With the participation of the German National Committee of the International Council of Museums (ICOM), the German National Library, the Federal Archives and the German UNESCO Commission, and in cooperation with ICOM Switzerland, the ICOM assistance project "Ukrainian Museums in Danger: A Three-Step Plan to Solve the Problem through Knowledge, Action and Visibility" (also known as "ICOM4Ukraine") was implemented, which ran from June 2023 to June 2024. It was funded by the ICOM Strategic Allocation Review Committee (SAREC). This project is now complete, but its results have enabled the professional digitisation of cultural heritage objects using software for scanning and developing 3D models of museum objects. As part of the project, twelve educational videos were created, filmed or translated into Ukrainian to provide the necessary professional knowledge about modern artefact digitisation methodology. The manuals "Standards for Museums and Recommendations for the Development of Education and Public Engagement in Museum Activities", developed jointly with Museum-digital and the initiative "Preserving Ukrainian Cultural Heritage on the Internet", are available on the Museum-digital channel (YouTube), on the websites of ICOM Ukraine, ICOM Germany, ICOM Switzerland, NEMO and the Association of German Museums (as free PDF documents), and have also been printed (300 copies) and distributed to Ukrainian museums.

Therefore, as can be seen from existing international practice, digital technologies are becoming an important tool for collecting accurate data and ensuring authenticity and integrity. In addition, high-resolution scanning and modelling technologies enable preventive and intervention measures to be taken to preserve and restore cultural

heritage. The digitisation process shapes the understanding of the need for interdisciplinary integration of specialists from various scientific and technological fields and must be accompanied by the mandatory preparation of a package of technical documentation for system administrators, programmers, database and website developers, as well as researchers. Another positive experience is providing the public with access to an online database of digitised cultural assets. Based on international legal acts, an algorithm for the digitisation of cultural artefacts has been developed as shown in Figure 1.

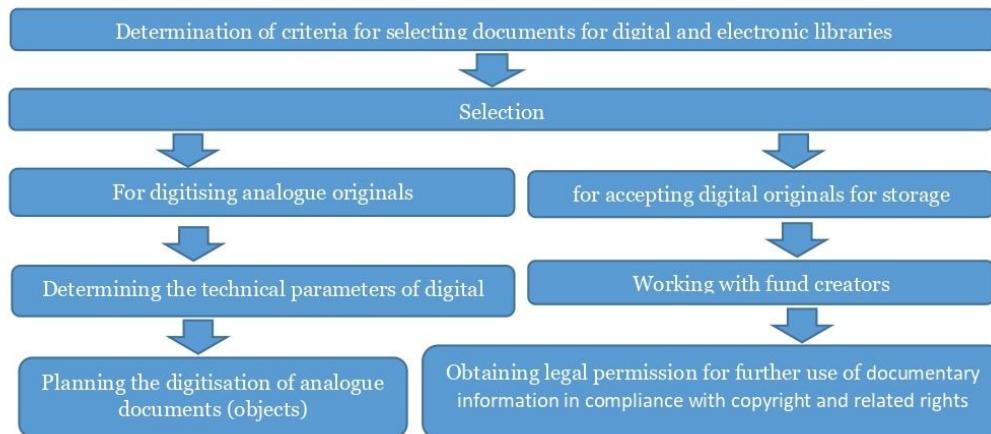


Figure 1. The Algorithm for the Digitisation of Cultural Artefacts

The “ALIPH” Foundation, which helps protect heritage during wars and other conflicts, has launched the #SaveUkrainianHeritage project, funded by the European Union (ALIPH, 2022). As part of this project, specialists from the Ukrainian company “SKEIRON” were able to conduct 3D scanning of Ukraine’s material culture monuments using laser scanning, photogrammetry, and structured light scanning to obtain accurate geometric data. Then, using Autodesk ReCap or Agisoft Metashape, Autodesk Maya or Blender, they reconstruct the data into digital 3D models. Specialists optimise the geometry, textures and appearance of objects, ensuring a visually appealing and realistic representation of cultural artefacts or heritage objects (Figure 2).



Figure 2. 3D Model of the Dominican Cathedral in Lviv, created by the “SKEIRON”

The international cultural initiatives discussed above demonstrate the formation of a comprehensive and multi-level system for protecting Ukrainian cultural heritage in the context of full-scale war. The main priorities for international support are keeping an eye on the illegal movement of cultural property (Interpol), emergency preservation of museum and archive collections (UNESCO, “ALIPH” Foundation), and, especially, digitising cultural heritage as a way to protect it (“Horizon Europe”, “SKEIRON”). Projects aimed at providing Ukrainian institutions with modern software, scanning equipment and professional training for specialists (“Blue Shield”,

ICOM) are gaining importance, contributing to the cultural sector's resilience to crisis challenges. An important result of international cooperation is Ukraine's integration into European and global digital infrastructures (UNESCO's World Heritage List, EU Cultural Heritage Cloud). The inclusion of Ukrainian sites in international registers strengthens Ukraine's cultural identity and counteracts attempts to destroy or appropriate its historical memory. This creates the conditions for the sustainable development of digital heritage preservation practices even after the end of hostilities.

State Cultural Initiatives to Preserve Artefacts Under Constant Attack

The Ukrainian state, for its part, is also taking active measures to protect its culture, even amid the escalating military conflict. The Ministry of Culture, together with the Security Service of Ukraine and the Prosecutor's Office, are gathering evidence to bring Russian war criminals to justice for the destruction of cultural property. And within the structure of the Office of the Prosecutor General, departments have been created to investigate crimes against cultural heritage. At the local level, cultural institutions in communities are funded. They finance and maintain their institutions themselves (Cabinet of Ministers of Ukraine, 2025).

The Ukrainian Cultural Foundation, which is the main state investor in the field of culture, has been operating under conditions of sharp funding cuts since 2023. The foundation is actively seeking ways to attract additional resources, striving to support more projects not only through state funding, but also through investments and partnership programmes (Ukrainian Cultural Foundation). On the initiative of the Ministry of Education and Science of Ukraine, the Ministry of Culture of Ukraine, the Ukrainian Centre for Cultural Studies and Google Ukraine, the "Authentic Ukraine" project was implemented to digitise Ukraine's cultural heritage register, which contains a collection of authentic audio and video compositions. The virtual platform consists of objects of tangible and intangible cultural heritage. The first one is presented in the form of virtual tours – illustrations of wooden churches from the UNESCO World Heritage List. The second illustrates examples of oral traditions, performing arts and traditional crafts, rituals and customs, and the culture of each region (Figure 3).



Figure 3. The Concept of Project "Authentic Ukraine"

(Ministry of Culture of Ukraine& Google Ukraine, 2017 – 2025)

Research focuses, in particular, on initiatives to create virtual museums and collections, given the location of material (physical) artefacts in areas where hostilities are ongoing. Since 2022, "SKEIRON", in collaboration with Google Arts & Culture, has been digitising Ukraine's cultural heritage as part of the "Ukraine is Hear" project. As a result of digitisation, artefacts are published on a single platform, providing free access to the treasures of Ukrainian museums for users from all over the world (Google Arts & Culture, n.d.). The online format

of the project allows users to explore and see in a few moments what would take days or even weeks in real life. Thanks to “SKEIRON”’s partnership with the Ministry of Culture and Strategic Communications of Ukraine and museums (the National Museum of Ukrainian History, the Museum of Decorative Arts of Ukraine, and the Lviv Historical Museum), the “Ukraine is Here” project offers an innovative and exciting method of discovering Ukrainian heritage sites. Ukrainian culture is represented in four sections: Culture, Architecture, Art, and Nature. In particular, there are archives of Ukrainian seasonal folk rituals and holiday traditions, traditional Ukrainian cuisine, the practice of creating pysanky (Easter eggs), folk songs, crafts, images of Ukraine’s breathtaking landscapes, biosphere reserves, and more. All information in the section is presented in Ukrainian and English. The website contains information about the history of Ukraine, the culture of the Crimean Tatars, unique crafts, and illustrations of finds from the Trypillian culture belonging to the National Museum of Ukrainian History. In addition, the website offers a 360-degree view of the Ukrainian ballet performance “Destiny” (Odessa Opera Theatre) (Google Arts & Culture, n.d.). The project website, developed by “SKEIRON”, features 3D models of 40 cultural heritage sites, which can be viewed in 360 degrees. In particular, there are images of the “Ancient Lviv” museum and the Archaeological Museum of the Ivan Krypiakevych, Kamianets-Podilskyi Castle, St. George’s Cathedral in Lviv, the Solomiya Krushelnytska Lviv Opera and Ballet Theatre, and St. Sophia Cathedral in Kyiv (Figure 4).

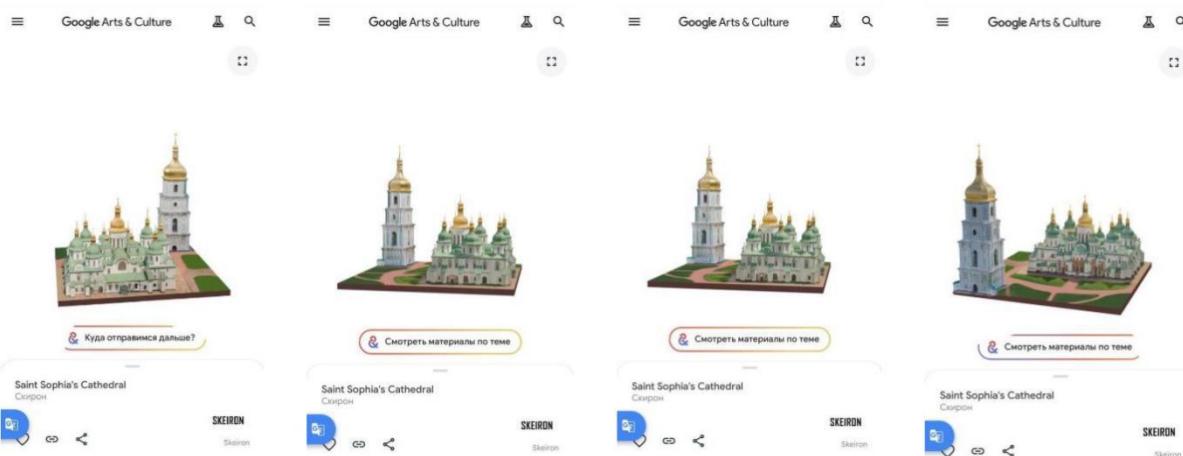


Figure 4. 3D model of St. Sophia Cathedral in Kyiv (2024)

“This collaboration will open up access to a wide global audience, allowing people from all over the world to learn about Ukrainian culture and history, including our work in particular. Thanks to Google, we are attracting funding for digitisation, finding new partners at the international level, and also providing informational support for the company and the project” (Chelyak, 2024). “SKEIRON” aims to create a map of all digitised objects in Ukraine. The company’s mission is to enable the study of authentic virtual presentations of cultural heritage, the creation of virtual tours, and the introduction of the most outstanding works of Ukrainian artists in virtual exhibition spaces.

“SKEIRON” aims to create a map of all digitised objects in Ukraine. The company’s mission is to enable the study of authentic virtual presentations of cultural heritage, the creation of virtual tours, and the presentation of the most outstanding works of Ukrainian artists in virtual exhibition spaces. However, it currently seems impossible to implement this initiative due to the escalation of the military conflict, regular shelling, prolonged power outages, and air raid alerts. The ongoing full-scale war poses constant risks to cultural heritage sites, limiting physical access for digitisation teams and increasing the risk of damage or destruction of sites before their documentation is complete. Technical challenges arise from the need for high-precision equipment, stable power supply, and secure data storage in a war environment. In addition, the project requires ongoing financial support and long-term international partnerships to ensure regular updates, platform maintenance, and the digitisation of new sites. Finally, ensuring accurate representation, multilingual accessibility, and ethical management of cultural data remains an ongoing responsibility for all partners involved.

The Kharkiv region of Ukraine is in a critical zone, given its border with the territory of the aggressor country.

Museums and cultural institutions in this region urgently need to be digitised and 3D models created in the virtual dimension. Therefore, the first priority was to implement a project to create a virtual museum of the Kharkiv National Academic Opera and Ballet Theatre named after M.V. Lysenko with the financial support of the Ukrainian Cultural Foundation (Ukrainian Cultural Foundation, 2024). The theatre's website features about six thousand exhibits (photographs from different years, sketches, costumes, programmes, posters, etc.) (Kharkiv Opera Museum Collection, n.d.). The project is the first virtual theatre museum in Ukraine, designed to preserve a unique archival collection from the risks associated with war. For over a year, the project specialists negotiated with museums and collectors, worked in archives, selected exhibits, digitised and catalogued them — with the aim of protecting both the theatre itself and the artistic community from the loss of information about the development of Ukrainian musical and theatrical culture.

The digital collection contains screen adaptations of national operas and ballets. Of particular importance are the premieres of works by Ukrainian composers (for example, the opera Taras Bulba by M. Lysenko, the Ukrainian ballet Pan Kanyovsky by M. Verykivsky, and others). Such projects illustrate Ukraine's cultural heritage in an interactive way, as digital works of art are combined with expert commentary, 3D visualisation and multimedia technologies (Figure 5).

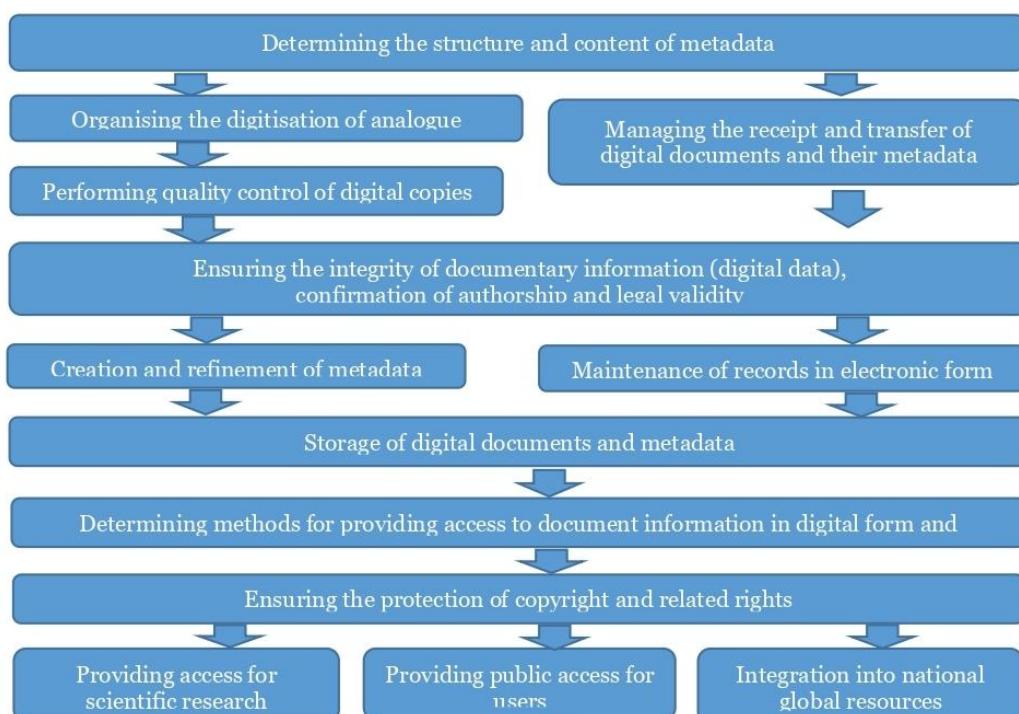


Figure 5. Scheme of Systematic Digital Transformation of Institutions that Preserve Cultural Heritage

The diagram summarises all the issues related to the digitisation of cultural heritage:

- strategies for the digital transformation of specific institutions, industries, and states;
- representation of Ukraine's cultural heritage in global international electronic information resources;
- the introduction of new research methods in the context of globally developed electronic communications;
- obtaining copyright and related rights, providing access to cultural heritage objects in accordance with the current regulatory framework of Ukraine and international law, taking into account existing national judicial practice and international experience;
- accessibility of digital content in the form of electronic information resources, such as websites, and their automated adaptability for use on various devices (stationary and mobile, with large and small screens, with different capabilities for ensuring the quality of the information reproduced);
- authenticity and reliability of digital copies of analogue originals

CONCLUSION

The results of the study prove that the issue of preserving Ukraine's cultural heritage in the context of escalating military conflict requires a comprehensive, progressive approach that combines international legal mechanisms with creative initiatives to introduce technological innovations for digitisation and the creation of virtual models. The research confirms that military actions pose a double threat to cultural heritage: the physical destruction of tangible objects and the systematic destruction of intangible cultural identity lead to the degradation of the cultural space as a whole – the loss of significant monuments, the severing of communication links and the weakening of intercultural exchange. The scale of the loss of cultural values is confirmed by numerous examples: the destruction of the Ivankiv Historical and Local History Museum with works by Maria Prymachenko (February 2022), the theft of more than 15,000 exhibits from museums in the Kherson region. These facts point to the systematic nature of war crimes against cultural heritage and necessitate the constant updating of a single digital register of losses. Therefore, UNESCO conducts ongoing monitoring to record damage and destruction of cultural heritage, and Interpol cooperates with Ukrainian law enforcement agencies to track the movement of art objects on the black market. Under such conditions, preserving tangible and intangible heritage becomes a strategic component of national resilience, security, and post-war reconstruction. The "ICOM4Ukraine" and "Memory of the World" initiatives provide Ukrainian museums with logistical and expert support for the urgent conservation of collections, staff training, and the creation of backup electronic catalogues.

An important conclusion of the study is the recognition of the critical role of digitisation as a tool for preserving cultural heritage. For example, the Kharkiv National Opera and Ballet Theatre Museum has created a digital archive of over 6,000 exhibits, including models, costume images, photographs and programmes. This demonstrates that digital tools can compensate for the physical vulnerability of cultural institutions in combat zones. The Ukrainian company "SKEIRON" regularly conducts 3D scanning of Ukraine's architectural monuments in collaboration with the "ALIPH" foundation. As part of the "Ukraine is Here" project (Google Arts & Culture), over 40 three-dimensional models of key Ukrainian cultural monuments have been created. Thanks to the systematic organisation of legalisation, digitisation, 3D modelling and the creation of virtual museums and open repositories, global promotion and recording of irreversible losses during military operations is ensured. However, there is a lack of funding for cultural initiatives in the country, leading to a reduction in cultural programmes, the closure of some institutions and the loss of skilled personnel. Therefore, the "ICOM4Ukraine", "Ukraine is Here", "Memory of the World", and "SKEIRON" projects are extremely important as they highlight the effectiveness of coordinated international initiatives and government programmes in expanding Ukraine's digital capacity and strengthening institutional readiness.

Finally, the results of the study demonstrate that the preservation of cultural heritage in wartime becomes an element of national resilience and security. International legal mechanisms – the norms of the Hague and Geneva Conventions – are directly applicable to documented cases of destruction and looting in temporarily occupied territories. At the same time, digital technologies – 3D scanning, VR/AR modelling, creation of online repositories – are becoming a key area of development for cultural policy and international cooperation. Therefore, the preservation of Ukraine's heritage is only possible on the basis of a comprehensive approach that includes legal protection, documentation of crimes, digital transformation, international support, and the development of internal cultural infrastructure. The successful examples of such projects prove that culture can survive even in the most difficult military conditions, and the creation of digital copies guarantees its continuity for future generations. The task of international law and global cooperation is to create conditions under which this culture can fully develop in a peaceful environment, thereby contributing to the diversity of world cultural heritage. Future research should combine legal analysis, institutional assessment and field-based documentation to bridge the gap between theory and practice. Without such a methodological refocusing, academic discourse risks remaining analytically detached from the cultural losses it seeks to conceptualise and prevent.

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