



Historical aspects of representing the Slavic pagan heritage in digital archives

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Abstract. The relevance of the study is due to the need to reflect on the role of digital technologies in preserving and representing pagan heritage as a component of the cultural memory of Ukraine and Europe. The purpose of the study was to carry out a comprehensive reconstruction of the historical aspects of representing Slavic pagan heritage within the digital archival environment. The methodology combined an interdisciplinary analysis of archival, archaeological, ethnographic, and digital data, applying historical-cultural, semiotic, and information-technological approaches. The results showed that pagan heritage functions as a multi-layered system of material and symbolic objects represented in different types of sources – from chronicle texts to archaeological artefacts. Analysis of chronicle records revealed regional variability in descriptions of cult practices, which correlates with ethnographic evidence of local ritual practices. Comparing archaeological catalogues with folklore collections made it possible to trace the chronological continuity of certain ritual motifs. Digitisation proved to be a factor in increasing the accessibility of materials, but was accompanied by challenges of standardisation, contextualisation, and the authenticity of metadata. Analysis of technical solutions indicated that only comprehensive integration of standards can guarantee long-term preservation and scholarly verification of digital copies. The study determined that digital archives of pagan heritage can perform not only a preservation function but also a reconstructive-analytical role, creating new models of relationships between texts, artefacts, and symbols. The development of digital humanities has enabled the creation of multimodal databases in which ritual practices can be visualised in a spatio-temporal dimension. The conclusions emphasise that the digital representation of pagan heritage is not only a technological process but also a cultural reconstruction requiring a balance between scholarly accuracy, preservation ethics, and openness of access. The results are intended for researchers in digital humanities, archivists, museologists, cultural policy developers, and specialists in managing digital collections concerned with the preservation and representation of intangible cultural heritage

Keywords: metadata; paradata; international standards; humanities; artefacts; chronicles

Introduction

The relevance of the topic lies in the growing role of digital archives in preserving and representing cultural heritage, amid the active development of the digital humanities and the transformation of archival practices. In the twenty-first century, the digitisation of historical

materials has become not merely a technical task but also a scholarly problem encompassing issues of authenticity, interpretation, and the semantic integration of heterogeneous data. Slavic pagan heritage, as a complex phenomenon of spiritual, ritual, and material culture,

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has proved to be one of the less represented in the digital space due to the fragmentary nature of sources, the difficulty of their classification, and the multi-layered character of cultural accretions. In this context, digital archives function not only as preservation tools but as spaces for reconstructing historical memory that shape a new format for comprehending pre-Christian culture. The need for a comprehensive study of the historical aspects of representing pagan heritage in the digital environment is determined both by current processes of digitising the humanities and by the necessity of integrating Ukrainian initiatives into a broader European and global context.

In the works of Ya. Kalakura & M. Palienko (2021), electronic archival studies were viewed as an innovative field of knowledge that establishes methodological foundations for the systematisation, preservation, and interpretation of digital resources. The authors emphasised that the development of this discipline contributed to the formation of a new scholarly paradigm of archival activity oriented towards informational openness, long-term data preservation, and the creation of national digital archives. The study by J. Hutson *et al.* (2024) focused on the use of machine learning for preserving cultural heritage, in particular for documenting multilingual artefacts and cultural practices. The authors highlighted the danger of losing linguistic and cultural diversity under the influence of globalisation processes and the need to create digital infrastructures that reflect the uniqueness of local cultures. In the work of I. Munoz-Pandiella *et al.* (2024), the EHEM project (Enhancement of Heritage Experiences: The Middle Ages) revealed the complexities of digitally restoring medieval artistic heritage through 3D modelling and visualisation technologies. The authors analysed methods of reconstructing the historical appearance of monuments, approaches to conveying colour and texture, and algorithms for reconstructing cultural context. Although these results advanced digital archaeology, the problem of semantic correspondence between reconstructed artefacts and their ritual or worldview function remained unresolved. A. Cappellotto (2020) focused on the evolution of digital scholarly editions, in which facsimile copies of texts began to play a central role in the scholarly representation of historical materials. The author stressed that digital images of manuscripts provide a new level of access to the material nature of the source and shape a different logic of its perception.

In the study by D. Luchev *et al.* (2024), a semantically structured web environment for working with South Slavic manuscripts was created, opening new possibilities for palaeographic analysis and digital representation of manuscript traditions. This initiative demonstrated how digital tools can provide a new quality of access to cultural heritage. The work of N. Tomova (2021) highlighted problems in the development of Bulgaria's archival infrastructure, emphasising a lack of qualified staff

and technical resources for effective digitisation of documents. The author underlined those documents have not only an administrative but also a cultural-historical function, yet the absence of funding threatens the loss of national memory. M. Chayani *et al.* (2025) described the activities of the "3D for Digital Humanities" Consortium, which contributed to the development of three-dimensional modelling technologies in the field of cultural heritage. The researchers emphasised the importance of data interoperability, the environmental sustainability of digital processes, and the need to create national repositories. C. Ward (2023) focused on archival interaction as a material experience that affects knowledge formation in archaeology. The author argued that each excavation archive is unique and that the processes of recording, storing, and interpreting materials directly shape archaeological knowledge. This research deepened understanding of the materiality of the archive, but did not address the potential of the digital environment for reconstructing such knowledge.

Previous works have provided substantial theoretical and technological foundations for the study of digital representations of cultural heritage, but they have not covered the historical and archival-source dimension of Slavic pagan heritage. Under-researched remain issues of methodological integration of digital tools with traditional archival practices, as well as the modelling of semantic links between archaeological, ethnographic, and folklore sources. The aim of the study was a comprehensive reconstruction of the historical conditions and forms of representing Slavic pagan heritage in the digital archival space. The objectives were: to systematise historical-archival approaches to studying Slavic pagan heritage; to analyse the use of digital standards and technologies in preserving and representing cultural heritage; and to identify directions for integrating Ukrainian archival initiatives into the international context of digital humanities.

Materials and Methods

The methodological foundation was built on an interdisciplinary approach combining archival, ethnographic, archaeological, philological, and digital-humanities methods. This combination is determined by the complex nature of the object – Slavic pagan heritage – which simultaneously encompasses tangible and intangible elements, source strata from different periods, and multifaceted forms of representation in archival collections. The methodological logic of the work was defined by reconstructing the research process from identifying source corpora to constructing digital models of representation. At the first stage, sources were classified by types of preservation, origin, and structural characteristics. The comparison criteria were: the chronological range of sources, their geographical area, the level of scholarly processing, and the form of representation (manuscript, field record, artefact, digital

object). The selection of these criteria was determined by the need to reflect the representativeness and variability of the source base and to trace different trajectories of cultural information transmission. Within this approach, the historical-comparative method was used to compare different categories of sources that record pagan elements. The comparison was carried out by criteria of typological relatedness of objects (symbolism, function in ritual, manufacturing material) and by the criterion of geographical distribution. This made it possible to trace how certain cult motifs acquired local variations and in which regions they exhibited more stable reproduction.

The second methodological block was devoted to the digital aspect of the study. Digitisation was viewed not as a technical process but as a scholarly-methodological process of representing cultural heritage. The main reference points were standards for digitisation, preservation of metadata, and semantic interoperability reflected in international recommendations. The methodology of the second block was based on a critical analysis of international standards for the digital representation of cultural heritage. The analysis was conducted through a comparative study of the functionality and conceptual foundations of the standards. To assess the interoperability potential of visual data, the International Image Interoperability Framework was examined, as it provides unified access to digital images. Metadata management standards, in particular the Metadata Encoding and Transmission Standard (METS) for structuring information packages and the Metadata Object Description Schema (MODS) for bibliographic description, were analysed in terms of their effectiveness for describing complex cultural heritage objects. In the context of digital archiving, attention was paid to Preservation Metadata Implementation Strategies (PREMIS) and the Open Archival Information System (OAIS) as a conceptual basis for ensuring the long-term preservation of digital objects. To analyse methods of semantic modelling, the potential of CIDOC CRM was examined, and to assess approaches to text markup, the Text Encoding Initiative was considered.

One component of the study was the method of digital comparison of cultural-heritage archiving policies and practices. State initiatives were analysed, such as the creation of an electronic catalogue of museum treasures and the activities of the "Museum Digitization Center". Reference to these examples is explained by the fact that they demonstrate the actual state of integration of digital technologies in the field of cultural preservation and reflect the transition of Ukrainian archives to a new data infrastructure. Within the analysis of digital processes, criteria of technical compliance were also used – formats, standards, metadata structures, and preservation of provenance/paradata. This enabled a comparison of Ukrainian practices with international initiatives such as the Europeana Foundation or the Smithsonian Institution,

which serve as benchmark examples of integrating multilingual and multi-format collections. The selection of these projects is explained by their compliance with long-term archiving standards and open-science principles. A separate methodological strand involved work with regulatory acts and international documents. The provisions of UNESCO (2023) reports on supporting the digitisation of Ukrainian cultural heritage were taken into account, as well as official Ukrainian initiatives such as the War & Sanctions report (2025). Their use was determined by the need to confirm the current state of preservation and losses of cultural objects and to show the context of wartime risks within which heritage digitisation is unfolding.

Results

The historical heritage of Slavic paganism and its archival representation

The historical significance of the Slavic pagan heritage should be understood as a complex, multi-layered reality that simultaneously includes tangible and intangible elements, transitional strata between pre- and post-Christian cultures, and later folklore-ethnographic accretions. Archival preservation practices make it possible to distinguish at least four broad categories of sources: chronicle/annalistic materials; ethnographic field records and collections (records of rites, folk songs, interviews); archaeological catalogues and excavation reports; and museum catalogues and object collections (idols, amulets, ceremonial items). Combining these source types makes it possible not merely to reconstruct individual elements of belief, but to identify mechanisms of transmission and transformation of religious representations across space and time. The analysis of symbolism and ritual practice requires distinguishing between primary religious signs (theonyms, cult objects, calendrical festivals) and secondary markers – toponyms, anthroponyms, and motifs in oral tradition. For example, calendrical-agrarian practices (spring and autumn rites, determining crop cycles) are recorded in folklore sources and ethnographic records as procedural rituals (processions around fields, sacrificial offerings, ritual songs), which can be compared with archaeological evidence of altars and symbolic objects at early medieval settlements.

Applied analytics concerning the reliability and research value of different corpora must also be specific. Chronicle references to "pagan rites" are specific to particular chronographers and regions; therefore, it is useful to conduct corpus-based counts of references to particular theonyms or ritual actions in selected manuscript groupings, comparing their frequency and geographical distribution. Ethnographic collections allow statistical assessment of the persistence of certain practices: for example, on the basis of regional collections, it is possible to identify which ritual motifs were preserved as "more than local" (i.e., have wider geographical diffusion) and in which regions they were transformed

into religious folk customs. Archaeological catalogues accompanied by spatial coordinates and dating make it possible to build spatio-temporal models of the diffusion of cult practices (for example, correlating amulet finds with the concentration of particular settlement

types). Using such models makes it possible to evaluate formally claims about the “pan-Slavic” or “local” character of particular cultural elements, making conclusions more rigorously substantiated. The analysis of source types is presented in Table 1.

Table 1. Categories of sources in archival preservation

Source type	Approximate chronological range/region	Representative example/content	Possible holdings/repositories (example)
Chronicle/annalistic texts (redactions)	11 th -15 th centuries; Kyivan Rus', eastern and southern Slavic regions	Manuscript redactions of chronicle compilations; information on cult practices	National libraries, research institutions; academic editions
Ethnographic field records (interviews, songs, descriptions of rites)	19 th -20 th centuries; local regions of Ukraine (Poltava region, Halychyna, etc.)	Textual collections, audio recordings, musical transcriptions of spring rites	Regional archives, ethnographic museums; original fonds
Archaeological catalogues/excavation reports	Early Middle Ages – period of formation of Slavic communities; various regions	Excavation reports, descriptions of objects (amulets, cult complexes)	Archaeological institutes, national databases, international repositories
Museum/object collections (idols, amulets)	Material artefacts with local attributions	Ceramics with cult decoration, figurines, amulets, ritual objects	Museums, regional exhibitions, university collections; catalogues

Source: compiled by the author on the basis of S. Plokhý (2006), J.A. Álvarez-Pedrosa (2021)

Table 1 classifies sources on Slavic pagan heritage into four main types – chronicle texts, ethnographic records, archaeological catalogues, and museum/object collections – clearly indicating their chronological range, content, possible repositories, and considerations relevant to digital description. Different source types impose different requirements for metadata, context, and technical processing (for example, 11th-15th-century manuscripts require philological markup, whereas archaeological reports require georeferencing and 3D models). In Ukrainian digital archives, textual and photographic materials predominate (45% and 30% respectively), while audio, video, and interactive media account for smaller shares – highlighting that different media require specific processing. At the same time, the table also underscores the importance of preserving context and structured metadata for scholarly value.

From the nineteenth century through to the twenty-first, conceptions of Slavic paganism have undergone substantial change – both in scholarly discourse and in the cultural-ideological field. In the nineteenth century, particularly in polonised and German/Austro-Hungarian regions of Central and Eastern Europe, Slavic paganism was viewed through the lens of Romantic nationalism. This was reflected, in particular, in attempts to reconstruct “primitive beliefs” as the basis of national identity (Leerssen, 2016). For example, M. Kujawska *et al.* (2015) focused on plant symbolism and folk beliefs from areas of Western Ukraine and Poland as part of an effort towards “national revival” through the past. At the same time, researchers of that period recorded folk traditions without sufficient temporal or contextual differentiation – for instance, labelling as “pagan” practices that may already have been relics of Christianised folklore. In the twentieth century, especially after the Second World War, scholars began to evaluate the source base for Slavic paganism more critically. On the one hand, the

volume of archaeological and ethnographic research increased; on the other, methodological attention to “late” sources intensified, including the influence of Christianity on folklore and hybrid cultural forms. It was emphasised, for example, that the traditional Slavic calendrical-ritual system is far from abstractly “pagan”, but exists in continuous dialogue with the Christian conception of time and festivity (Beissinger, 2022). Moreover, the study of paganism should not be confined to archaeology or chronicles alone: folklore data, material remains, and contextual socio-cultural models must be combined. In the twenty-first century, the cultural-ideological frame has shifted again: research into paganism has received a new impetus amid growing interest in national identity, revival of traditions, and digital archival initiatives. At the same time, scholars point to the risks of popularising pseudo-pagan narratives lacking a source basis. Calendrical rites and folk beliefs have “superficially” adopted Christian structures while retaining earlier motifs – requiring careful interpretation. Thus, the transformation of conceptions of paganism involves not only changing scholarly approaches, but also changing substantive emphases – from Romantic idealisation to methodologically grounded, multidisciplinary analysis.

In the Ukrainian context, the specifics of preserving pagan artefacts and texts in national archives have several distinctive features. First, the territory of modern Ukraine historically belonged to different imperial, political, and cultural formations (Lithuania-Poland, Muscovy/Russian Empire, Austro-Hungary), meaning that archival holdings are dispersed across many institutions, with different languages of documentation and accounting standards. This produces metadata fragmentation and complicates pan-regional research. Second, in the twentieth century, warfare, Soviet policies, deportations of local populations, and destruction of cultural monuments led to losses of archival materials or to poor

preservation. For example, more than 110,000 artefacts were removed from the territory of modern Ukraine to Russian museums by 2023, complicating restitution, access, and cataloguing (Texty, 2023). In addition, a report by Ukraine's state service for cultural heritage protection recorded 1,284 cultural heritage objects stolen or removed from Ukraine as of mid-2025 (War & Sanctions, 2025). Third, Ukraine has seen active development of digital archives and digitisation initiatives, but without sufficiently unified metadata description or coordination between holdings structures. This creates a challenge: although the technological base is expanding, foundational issues of standardisation, context preservation, and ensuring long-term access remain unresolved.

Ukrainian digital archives, museums, and cultural institutions are making an active contribution to cultural heritage preservation by creating new platforms, registers, and infrastructures for access and analysis of archival materials. For example, the Ministry of Culture of Ukraine (2024) reports the creation of an electronic catalogue of museum treasures – a register divided into an internal section (for museums) and a public portal, simplifying public access. Another example is the "Museum Digitization Center", which by 2025 had digitised more than 12,000 museum objects and created more than 100,000 images, operating mobile centres in Ukraine's regions under martial law. Statistics also indicate significant growth in digital archives: between 2021 and 2023, the number of digitised documents in Ukrainian digital archives increased by 63.5% to 8.5 million units, and the number of online requests rose by 106.7% to 3.1 million annually (War & Sanctions, 2025). These facts point to several aspects. Digitisation helps preserve access under conditions of physical threat (armed conflict, archive damage, relocation of holdings). For example, according to UNESCO (2023), support for digitising museum and documentary collections in Ukraine was strengthened after 2022. Ukrainian digital archives are not only preserving materials but also beginning to create metadata structures, registers, and catalogues that enhance interoperability and scholarly usability; the Register of Museum Holdings of Ukraine is one such tool. At present, Ukraine has a number of digital archival and museum initiatives that create conditions for safeguarding cultural heritage – but they do not have a specialised focus on Slavic paganism. Representation of the pre-Christian legacy is fragmentary and unsystematised. Although the contribution is substantial, challenges remain: not all materials are yet prepared with scientifically acceptable metadata; metadata standardisation, semantic markup, and long-term preservation are still in progress. For example, a digital archive may contain high-resolution images but lack reliable provenance information or links to archaeological/ethnographic context, limiting their scholarly value. For the study of pagan heritage, this means that Ukrainian archives have significant potential, but require stronger semantic infrastructure, interoperability, and international integration.

There are also problems of reliability and interpretation in the historical sources on paganism. In essence, the pagan practices of the ancient Slavs did not leave a large body of direct written testimony: the principal sources are chronicles and annals written after Christianisation, and later folklore and ethnographic records. Chronicle sources were produced by monasteries or church institutions and often had political or ideological purposes – for example, legitimising authority or demonstrating the "transition" of pagan peoples to Christianity (Dynda, 2025). Accordingly, descriptions of pagan cults in such sources may be biased or stylised. Archaeological materials, although they appear "materially objective", also present source-related challenges: objects lacking clear stratigraphic or contextual links are sometimes misinterpreted as cultic. For example, not every ceramic figurine is necessarily religious, and the space between settlements and cult centres requires spatial analysis. Ethnographic materials collected in later periods suffer from "retroactive" transfer of motifs: an informant may present a tradition through the lens of the twentieth century, modern ideas, or reconstructions that do not correspond to the original practice.

Research on Slavic pagan heritage requires constant methodological reflection: philological, ethnographic, archaeological, and digital approaches must be combined; sources must be assessed not as authentic "snapshots" of paganism but as complex cultural products shaped by specific historical and social circumstances; and the national-historical context affecting preservation, access, and interpretation must also be taken into account.

Digital representation of pagan heritage: Technologies, challenges, and prospects

Within the humanities, the digital representation of cultural heritage is becoming a major avenue for preserving historical memory and reconstructing the past. The issue of digitising Slavic pagan heritage – a complex of tangible and intangible artefacts, mythological texts, archaeological finds, and folklore testimonies that constitute the deep foundation of pre-Christian culture – is gaining relevance. Its digital reproduction not only ensures access to sources for researchers and wider audiences, but also creates preconditions for interdisciplinary analysis using methods of digital humanities, geoinformation technologies, and semantic data modelling. Under conditions of wartime threats, the displacement of cultural valuables, and the risk of losing authentic artefacts, the digital form becomes one of the effective tools for long-term preservation and representation of national heritage. However, the digitisation of pagan cultural heritage is accompanied by a number of challenges – technical, ethical, interpretive, and methodological. Problems of metadata standardisation, the adequacy of digital copies in relation to originals, preservation of context, and the polysemy of mythological texts require a comprehensive approach combining archival studies, historical anthropology, archaeoinformatics, and digital philology. Digital archiving technologies are presented in Table 2.

Table 2. Digitisation and digital technologies for archives of pagan heritage

Component/task	Technical/methodological description (what to do)	Standards/formats/metadata (recommended)	Implementation example/project (specific data)
Selection policy for digitisation	Clear criteria of scholarly value, vulnerability, and accessibility; prioritise unique sources at high risk of loss (archaeological artefacts lacking stratigraphic context; primary ethnographic field records identifying the informant). Develop access and licensing policies for scholarly re-use	Documented institutional selection policy; rights metadata (CC licences or restrictions)	Europeana and national projects prioritise rare/vulnerable holdings; Europeana aggregates >58 million records from ~3,000-4,000 institutions (as of 2024-2025)
Technical standards for digitising images and documents (2D)	Create master copies in uncompressed or lightly compressed formats (TIFF 6.0, 16-bit for images). Set optical resolution by object type. Preserve lossless masters and produce JPEG2000/IIIF-served access versions	Formats: TIFF (master), JPEG2000 (web access); IIIF for delivery/interactive viewing; METS/MODS/ALTO/TEI for text encoding. IIIF recommended for high-quality images	Incorrect ppi/format choices hinder later scholarly work; storage constraints (large TIFFs)
Descriptive and semantic markup standards	Separate descriptive, administrative, technical, and preservation metadata. For cultural objects, use ontological description (CIDOC CRM) for semantic integration of heterogeneous sources (text ↔ artefact ↔ geography)	Dublin Core/MODS for basic records; METS for package containerisation; PREMIS for preservation metadata; CIDOC CRM for semantic links; TEI for texts (chronicles, transcripts)	Absence of CIDOC CRM prevents cross-queries between archaeology/ethnography/chronicles; weak metadata quality impedes analysis
Technologies for 3D documentation of artefacts and spatial objects	Choose method by scale: photogrammetry (structure-from-motion) for small objects; stationary/mobile laser scanning (LiDAR) for architectural/landscape complexes; integrate point clouds, textured meshes, and 3D reconstructions	Formats: LAS/LAZ (point clouds), PLY/OBJ/FBX (mesh), glTF (distribution); capture metadata (equipment, accuracy, GPS/RTK), PROV/paradata (processing steps)	3D data are heavy; require major compute/storage and comprehensive paradata to be scientifically usable
Geolocation integration and GIS context	Georeference archaeological finds and locations of ethnographic documentation: GPS/RTK coordinates, site polygons, cultural landscape layers. Link to spatial databases (GeoJSON, PostGIS) and integrate into GIS environments for spatio-temporal analysis	GeoJSON/KML for web layers; coordinate systems WGS84/local CRS; spatial metadata standards (INSPIRE for the EU)	Incorrect CRS or missing accurate coordinates prevents reliable spatial correlations
Repositories and platforms for preservation and publication	Choose between local repositories and aggregators: store master files in repositories guaranteeing long-term preservation; publish partly via aggregators (Europeana) or specialised 3D platforms (Smithsonian)	IIIF for images, OAI-PMH/APIs for metadata; replication across multiple geographic nodes; persistent IDs (DOI/ARK/Handle)	Europeana: >58 million records from ~3,000-4,000 institutions (2024-2025) as a large-scale aggregation example
Preservation and long-term stewardship (bit-preservation, migration)	Formal preservation policy: regular checksums, replication, integrity monitoring, format-migration plan. Maintain PREMIS records per digital object	PREMIS as preservation metadata; OAIS-aligned repositories	Even well-digitised objects become unusable without preservation operations; migrations are costly
Paradata and provenance for scholarly reproducibility	Record digitisation procedures: device/parameters, personnel, date, software and processing parameters (calibration, filtering), file versions. Paradata are critical for evaluating model quality	PROV-O (W3C) for process description	Smithsonian and some major 3D projects document paradata for thousands of models
Interoperability and semantic integration	Build mappings between TEI/METS/MODS/CIDOC CRM; develop domain ontologies (e.g., "pagan tradition", "rite", "artefact", "theonym") for search and semantic linking	CIDOC CRM + profiles (CRMdig, CRMgeo, etc.) for spatio-semantic links; TEI for texts	Lack of semantic mappings blocks comparative analytics across collections
Operational costs and scaling (digitisation economics)	Costs depend on material type: per-page documents, per-hour audio/video, per-hour on-site 3D scanning	Use ENUMERATE methods for cost estimation; budget by material type and required quality	Poor estimates halt projects; 3D projects are capital-intensive

Note: ALTO – Analysed Layout and Text Object; LiDAR – Light Detection and Ranging; LAS – Laser File Format; LAZ – Compressed LAS; PLY – Polygon File Format; OBJ – Wavefront Object File; FBX – Filmbox; glTF – Graphics Language Transmission Format; RTK – Real-Time Kinematic; PROV-O – Provenance Ontology; KML – Keyhole Markup Language; WGS84 – World Geodetic System 1984; CRS – Coordinate Reference System; INSPIRE – Infrastructure for Spatial Information in the European Community; OAI-PMH – Open Archives Initiative Protocol for Metadata Harvesting; ARK – Archival Resource Key; ENUMERATE – European Network for Cultural Heritage

Source: compiled by the author on the basis of N. Poole (2010), S. Snyderman *et al.* (2015), Smithsonian Institution (2023), M. Storeide *et al.* (2023), V. Bachi *et al.* (2024), I. Siliutina *et al.* (2024)

The digitisation process for archival sources of pagan heritage should be treated as a project sequence in which every step (from selection to long-term preservation) materially affects subsequent possibilities for scholarly analysis. Virtually all major aggregators and specialised 3D initiatives demonstrate that without standardised metadata and paradata, corpora have limited scholarly value even if they are technically “digitised”. For example, the Smithsonian Institution (2023) documented that a library/department reached approximately 3,000 models and continues active workflow automation – an example of a centralised institutional approach to 3D with a focus on paradata and on the glTF format for open distribution. This approach illustrates how scientifically robust documentation (paradata + PROV + metadata) enables broad re-use of materials. Aggregators such as Europeana demonstrate large-scale indexing: the platform contains more than 58-59 million images/records from several thousand institutions (as of 2024-2025). This scale highlights the need for unified metadata (with 42% of content available for free re-use according to Europeana Analytics).

Critical technical decisions for preserving the scholarly value of digitised materials include the choice of image formats and compliance with international metadata standards. The TIFF file format preserves the maximum amount of primary information and is used for research and conservation purposes, whereas International Image Interoperability Framework (IIIF) delivery is optimised for open web access, balancing quality and loading speed. Standards such as CIDOC CRM and PREMIS play key roles in ensuring long-term preservation and interoperability. Without the CIDOC CRM model, it is impossible to provide semantic integration of archaeological finds, ethnographic descriptions, and chronicle sources within a single digital environment. At the same time, PREMIS is a core mechanism for formally controlling preservation actions, documenting changes, and tracking the authenticity of digital copies.

Problems of interpreting pagan texts and artefacts in digital form remain among the most complex issues in humanities informatics. Data and technologies can reduce uncertainty but cannot eliminate it entirely, because any digital reconstruction contains an interpretive component. An effective technical solution is the provision of detailed paradata – metadata about the process of creating a digital object, including information on scanning parameters, lighting, camera calibration, and software. A successful implementation of this approach is provided by Smithsonian Institution (2023) 3D projects, which publish complete paradata packages alongside 3D models, increasing the scientific reproducibility of results. In addition, each digital object should be linked to its provenance and include a “confidence” field reflecting the reliability level of the interpretation. This approach enables quantitative analysis of degrees of trust in different source types, particularly when

reconstructing pagan symbols or cult artefacts. This practice is used in international digital archives operating on the basis of PREMIS and CIDOC CRM. For archaeological materials, the recording of stratigraphic context and geocoordinates is also critical. Without these data, an artefact loses a substantial part of its scholarly meaning, since it cannot be anchored to a specific cultural tradition or historical period. The use of GIS and formats such as GeoJSON or PostGIS enables spatial modelling of the distribution of ritual practices and relationships between regions. An example of successful integration of such technologies is the CyArk initiative, which creates high-precision geospatial models of archaeological sites worldwide.

For the Ukrainian archival and research environment, the task is to develop a staged digitisation strategy. At the first stage, it is advisable to conduct an audit of archival holdings to identify vulnerable collections – nineteenth–twentieth-century ethnographic records, manuscript texts, and archaeological reports containing evidence of pre-Christian beliefs. From a technical perspective, preserving artefacts calls for 3D scanning in cooperation with international programmes such as CyArk or Open Heritage, or for establishing university laboratories of digital archaeology. Photogrammetry is effective for small objects, while laser scanning (LiDAR or terrestrial laser scanning) is suitable for large monuments. A mandatory component should be the preservation of paradata according to the PROV-O model, enabling documentation of the process of creating a digital replica. At the preservation level, a long-term preservation plan must be created: storing master copies in two geographically separated centres, verifying checksums, monitoring file integrity, and performing regular format migration. These principles are based on PREMIS recommendations and the OAIS concept, which define international standards for digital preservation. In scholarly terms, the completeness of representing pagan heritage in the digital space is determined not only by the number of digitised units, but also by the quality of their metadata, paradata, and semantic integration. Only a combination of high-quality 2D digitisation, 3D documentation, spatial data, and relevant standards makes it possible to conduct rigorous corpus-based and spatio-temporal analyses required for adequate scholarly reconstruction of pagan practices.

The interpretation of pagan texts and symbols faces a number of interdisciplinary challenges that become salient in the digital environment. First, pagan symbols and texts are polysemous: they function simultaneously as ritual, marker, mythological, and socio-cultural elements, which complicates unambiguous classification. In digital form, when texts are transformed into machine-readable format – for example through Optical Character Recognition or structured markup – there is a risk of losing nuances: apographic variants, Latinisms, insertions of Christian rhetoric, and local toponyms may

be lost or simplified. This creates a challenge because subsequent analysis may be based on “levelled” or reduced data, distorting results. Second, contextual loss in digital representations is a significant problem. When an artefact or text is digitised but metadata do not include clear data on creation time, socio-cultural conditions, physical context, or stratigraphic linkage, the researcher loses the possibility of corrective interpretation. In the context of pagan symbolism, this means that a symbol that may have had a local meaning (e.g., a ritual sign) may be presented as a “pan-Slavic symbol” even though it might have been regional, late, or blended with Christian tradition. For example, Western European classification ontologies may inadequately represent Eastern European epigraphic materials, creating “interpretive errors” when transfer into digital environments (Tamrazyan & Hovhannisyanyan, 2025). Third, adapting traditional analytical methods (ethnographic, textual, archaeological) to digital forms requires rethinking them. For example, the folkloristic interpretation of a rite in a field record follows an “informant–rite–record” logic, but in a digital corpus the rite may be represented only as a textual transcription without audio or video, or without indication of collective context. Additionally, digital humanities tools such as named-entity recognition or symbol visualisation face technical problems: historical documents have archaic fonts, defects, and mixed languages, which reduces automatic recognition quality. Practically, this means that when creating digital archives containing pagan-heritage materials, it is necessary to ensure extended metadata, provenance, paradata, and the ability to preserve interpretive variants. It is also necessary to encourage multimodal representations (text + image + audio/video + georeferencing) to minimise contextual loss. These measures increase the scholarly usability of digital corpora for interpreting pagan symbols and practices (Kettunen *et al.*, 2016).

Digital humanities open new horizons for studying Slavic paganism. It enables the creation of corpora of digitised texts, artefacts, and symbolic representations that make it possible to conduct large-scale statistical, frequency-based, and spatio-temporal analyses (for example, the frequency of theonyms, or the geographical spread of certain symbols). This increases interpretive objectivity compared to traditional case studies. Digital humanities also stimulate interdisciplinarity – combining archaeology, ethnography, philology, semiotics, and computer science – within a model described as “Digital Cultural Heritage meets Digital Humanities” (Münster *et al.*, 2019). Prospects include applying artificial intelligence and semantic technologies to analyse symbolic forms and artefacts; for example, computer vision models and knowledge graphs can improve the quality of cultural-heritage description (Ignatowicz *et al.*, 2025).

Given the ambiguity of Slavic paganism and symbolism, digital humanities can offer innovations such as interactive visualisations of symbols in the context of

archaeological finds, modelling the transmission of ritual practices through spatio-temporal maps, and applying topic modelling to folklore records and chronicles within digital corpora. Scientifically, this means more reliable conclusions: statistical grounding can be provided (e.g., how many artefacts bearing a given symbol were found in a specific region), and hypotheses about the spread of pagan practices can be spatially tested. Digital humanities also enable the incorporation of new sources (e.g., audio/video recordings of rites, 3D models of artefacts) and their linkage with textual information. However, digital humanities do not automatically eliminate methodological problems: critical reflection is required at the stages of modelling, metadata markup, and interpretation of results. 3D models alone do not guarantee interpretive accuracy; the decisive factor is the combined presence of context, metadata, and paradata (Pisani *et al.*, 2024).

For research on Slavic paganism, this means that digital methods should be integrated with traditional ones: philological analysis, ethnographic interviews, and archaeological context. Digital platforms should provide not merely viewing of artefacts or texts, but tools for querying, correlation, visualisation (e.g., GIS maps, 3D services), and statistical analysis. Accordingly, an integrated digital-humanities approach to Slavic pagan heritage is both promising and necessary within the humanities. Finally, successful implementation of these prospects requires three components: high-quality data (metadata, context), technical infrastructure (repositories, APIs, visualisation services), and human resources (researchers with digital competencies, interdisciplinary teams). In Ukrainian scholarship, this entails strengthening joint initiatives between archives, universities, and digital humanists to create open platforms for the study of Slavic paganism.

Discussion

The discussion of the study’s results was conducted in the context of comparison with works addressing various aspects of the digital representation of cultural heritage, the legal regulation of access to it, and the transformation of archival methodology under conditions of digitisation. A common idea across all reviewed works is that digital technologies not only expand the possibilities for preserving cultural assets but also reshape the very notions of authenticity, accessibility, and interpretation of the past. In this context, the results of the study aligned conceptually with most approaches, but differed in the depth of interdisciplinary analysis and in an orientation toward semantic integration of heterogeneous sources.

In comparing the study’s results with the work of I. Carbajal & M. Caswell (2021), a shared understanding emerged of the archive not only as a technical preservation system but as a dynamic space of scholarly interpretation. I. Carbajal & M. Caswell emphasised seven concepts of digital archives – materiality, context, scale, appraisal, use, connections, and sustainability – which

enable rethinking archival structures within a digital ecosystem. The results obtained confirmed these positions, since the digital representation of pagan heritage required not only preserving sources but also revealing the contexts of their use and the semantic links between different forms of data – textual, archaeological, and visual. However, unlike the more general approaches proposed by I. Carbajal & M. Caswell, the study focused on the specificity of Eastern European cultural and religious heritage, where archival space was shaped by colonial, ecclesiastical, and Soviet policies, creating a need to reconstruct lost semantics through digital models.

D. Mantoan (2025) identified three fundamental challenges of digital archival practice: the blurring of boundaries between archives and databases, the loss of the physical context of originals, and the tension between archival and data-oriented management logics. The study's results confirmed these issues: reconstructing pagan heritage digitally was accompanied by loss of authentic object context, necessitating detailed provenance and paradata records. At the same time, it appeared that for Ukrainian archives the distinction between traditional storage and dynamic databases had not only a technical but also an ideological dimension connected to the decolonisation of cultural memory. Unlike the general European examples discussed by D. Mantoan, the Ukrainian context showed greater dependence on political factors and volunteer digital initiatives compensating for the absence of a centralised archival strategy. In comparison with T. Mazali *et al.* (2021), who emphasised the importance of metadata unification, format standardisation, and interoperable platforms, the study confirmed the practical significance of these principles. It established that effective representation of pagan heritage depended on compliance with IIIF, METS, PREMIS, and CIDOC CRM standards, which enable integration of textual, archaeological, and geospatial data into a single digital system. T. Mazali *et al.* focused primarily on multimedia objects, while the study emphasised comprehensive semantic integration combining text corpora, 3D models, and spatial coordinates. Both approaches converged on the conclusion that the long-term sustainability of digital archives is possible only when technical infrastructure is combined with methodological transparency and documentation systems supporting scholarly reliability.

In G. Marsili & L. Orlandi (2020), attention focused on creating an integrated digital environment for presenting Byzantine and post-Byzantine cultural heritage through Europeana, aiming not only at preservation but also at popularisation among scholars and the public. The study's results aligned with the conclusion that archival resources must balance scholarly reliability and public accessibility, but the Byzantine Art and Archaeology Research and Technology (BYZART) project focused primarily on increasing object numbers and visual

representation, whereas the study emphasised the analytical potential of data and metadata standardisation as a basis for reconstructing historical processes. The difference lay in methodology: in BYZART, digitisation functioned as collection-building and cataloguing, while in the study it was treated as an instrument for reconstructing cultural-semantic links between heterogeneous sources – archaeological, ethnographic, and chronicle. Both highlighted interdisciplinarity and visual accessibility, but BYZART remained mainly a technical platform, whereas the study framed digital representation as a cognitive process shaping historical memory.

The results of G. Geser *et al.* (2022) pointed to a structural metadata crisis and insufficient repository integration, corresponding to the study's conclusions about the fragmentary and heterogeneous nature of archival sources for pagan heritage. Their emphasis on the FAIR principles (Findable, Accessible, Interoperable, Reusable) converged with the study's position on openness, unification, and reusability. However, G. Geser *et al.* had a more technical focus, concentrating on statistical assessment of digital infrastructures and practice prevalence, whereas the pagan-heritage analysis considered these issues in the context of historical reconstruction and semantic interpretation. Both agreed on the need for unified formats and metadata, but the study extended beyond the technological level by linking digital archiving problems to cognitive and cultural aspects of reconstructing ancient religious systems. Thus, G. Geser *et al.* supported technical conclusions but remained outside the analytical dimension of cultural transmission.

D. Novák *et al.* (2023) established that digital archiving of archaeological data in Europe remains fragmentary and dependent on state policy, fully correlating with the study's findings on fragmentation of Ukrainian archival holdings related to pagan heritage due to historical, political, and wartime factors. D. Novák *et al.* emphasised the need for political intervention, unified procedures, and a centralised approach, whereas the study considered an integrated platform as an intellectual system capable of enabling semantic interaction across data types. Both recognised that without common standards and clear coordination, digital archival heritage loses its scholarly value. D. Novák *et al.* highlighted administrative-organisational aspects, while the study focused on methodological reconstruction and interdisciplinary integration as the basis for preserving the intangible components of paganism. Comparison indicated a gradual shift from an infrastructural to a cognitive-humanistic understanding of digital archival work, reflected in the broader perspective implemented in the study.

M. Markellou (2023) showed that the digital transformation of cultural heritage depends in part on the legal-regulatory environment, which can either stimulate or restrict open access to archival materials. During the COVID-19 pandemic, digital technologies supported

cultural institutions, yet in Greece, as in many European countries, access to digitised collections remained limited due to complex licensing mechanisms and paid-permit requirements. This resonated with the study's findings, which also recorded obstacles linked to regulatory frameworks, the lack of open protocols, and uncertainty regarding copyright over digital reproductions of pagan artefacts. Unlike M. Markellou focus on legal barriers and the need for legislative reform, the study treated digitisation as a broader phenomenon encompassing technological, semantic, and humanistic dimensions. The comparison indicated that the Greek case reflects a typical European pattern: a gap between the technical potential of digital tools and conservative legal frameworks. The analysis thus confirmed that effective digital representation depends not only on technological capacity but also on legal flexibility, consistent with conclusions about the need for adaptive regulatory mechanisms for preserving pagan heritage.

G. Lechleitner (2021) interpreted digitisation not merely as a technical process of converting documents to digital form, but as a factor driving profound transformation in archival science. The shift from physical to digital archives changes principles of archival theory – authenticity, context, provenance – as well as methods of source appraisal. This view closely matched the study's approach, which likewise argued that digital copies not only preserve data but also create a new form of cultural existence in which the source acquires a multi-layered identity – material, metadata-based, and interpretive. G. Lechleitner also highlighted risks of contextual loss in digitisation, aligning with the study's identified problems of polysemy in pagan symbols and the need for enriched metadata to restore semantic connections. The difference was in subject focus: G. Lechleitner analysed institutional archival practices, while the study used an interdisciplinary base combining archaeological, ethnographic, and folklore sources within a unified digital context. Both converged on viewing digitisation as a rethinking of the nature of the archive, but the study went beyond the institutional frame, demonstrating a shift toward a new ontology of memory in digital space.

Overall comparison showed that research in digital heritage – despite differences in thematic fields, legal emphases, and technical strategies – shares a tendency to understand digitisation as a multi-level socio-cultural process. All reviewed works confirmed that effective preservation of the past requires integration of technological innovation, regulatory reform, and humanistic reflection. Against this background, the study's results extended these approaches by demonstrating that the digital representation of pagan heritage not only ensures technical data preservation but also creates a new cognitive model of historical memory in which the digital archive becomes an active space for reconstructing cultural experience.

Conclusions

The study demonstrated that the historical significance of Slavic pagan heritage is a complex, multi-layered reality encompassing tangible and intangible elements, transitional strata between pre- and post-Christian cultures, and later folklore-ethnographic accretions. Archival preservation enabled the identification of four main categories of sources: chronicle materials, ethnographic field records, archaeological catalogues, and museum collections, which together made it possible not only to reconstruct individual belief elements but also to establish mechanisms of transmission and transformation of religious representations across space and time. Symbolism and ritual practice required differentiation between primary religious signs and secondary markers, reflected in an integrated analysis of calendrical-agrarian practices recorded in folklore and ethnographic sources as procedural rituals, compared with archaeological evidence of altars and symbolic objects at early medieval settlements. Applied analysis of reliability and research value showed that each source type requires a specific approach: chronicle mentions of pagan rites are regionally specific, necessitating corpus counts of theonyms and ritual actions in selected manuscript groups; ethnographic collections enable statistical assessment of practice persistence and mapping of ritual-motif diffusion; archaeological catalogues with coordinates and dating support spatio-temporal modelling of cult-practice distribution, allowing formal evaluation of claims about pan-Slavic versus local cultural elements.

The Ukrainian context of preserving pagan artefacts is characterised by fragmentation of holdings due to historical incorporation into different imperial structures, losses caused by warfare and Soviet policies, and rapid development of digital archives that nevertheless face problems of metadata standardisation and long-term access. Digital representation of pagan heritage has emerged as a direction for preserving historical memory, but digitisation involves technical, ethical, and methodological challenges. Analysis of digitisation standards showed the critical importance of image-format choices, compliance with international metadata standards, and provision of detailed paradata for scholarly reproducibility. Interpretation of pagan texts and symbols in digital environments confronts polysemy, contextual loss, and the need to adapt traditional analytical methods, requiring extended metadata, provenance, and the capacity to preserve interpretive variants. Digital humanities open new horizons through corpora of digitised texts, artefacts, and symbolic representations enabling large-scale statistical and spatio-temporal analyses, but successful implementation depends on three components: high-quality data with adequate metadata and context, technical infrastructure (repositories and visualisation services), and human resources with digital competencies and interdisciplinary expertise. A key limitation was the fragmentary and

heterogeneous nature of archival sources, which complicates building coherent semantic models due to missing unified metadata and digitisation standards. A promising direction is the development of an integrated digital platform using artificial intelligence for semantic integration of heterogeneous sources (from archaeological artefacts to folklore texts), enabling interdisciplinary modelling of the historical dynamics of pagan practices.

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Історичні аспекти репрезентації язичницької спадщини слов'ян у цифрових архівах

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Анотація. Актуальність дослідження зумовлена необхідністю осмислення ролі цифрових технологій у збереженні та репрезентації язичницької спадщини як складової культурної пам'яті України та Європи. Метою дослідження було здійснити комплексну реконструкцію історичних аспектів репрезентації слов'янської язичницької спадщини в цифровому архівному середовищі. Методологія поєднувала міждисциплінарний аналіз архівних, археологічних, етнографічних та цифрових даних із застосуванням історико-культурного, семіотичного та інформаційно-технологічного підходів. Результати дослідження засвідчили, що язичницька спадщина функціонує як багаторівнева система матеріальних і символічних об'єктів, репрезентована в різних типах джерел – від літописних текстів до археологічних артефактів. Аналіз хронікальних записів показав регіональну варіативність описів культових дій, що співвідноситься з етнографічними даними про локальні ритуальні практики. Порівняння археологічних каталогів із фольклорними збірками дозволило простежити хронологічну тяглість окремих обрядових мотивів. Оцифрування джерел виявилось чинником забезпечення доступності матеріалів, проте супроводжувалося викликами стандартизації, контекстуалізації та автентичності метаданих. Аналіз технічних рішень засвідчив, що лише комплексна інтеграція стандартів може гарантувати довготривале збереження та наукову верифікацію цифрових копій. У ході дослідження визначено, що цифрові архіви язичницької спадщини здатні виконувати не лише функцію збереження, а й реконструктивно-аналітичну роль, створюючи нові моделі взаємозв'язків між текстами, артефактами та символами. Розвиток цифрової гуманітаристики надав можливість створення мультимодальних баз даних, де ритуальні практики можуть бути візуалізовані в просторово-часовому вимірі. У висновках наголошено, що цифрова репрезентація язичницької спадщини є не лише технологічним процесом, а й культурною реконструкцією, яка потребує балансу між науковою точністю, етикою збереження та відкритістю доступу. Результати дослідження призначені для науковців у галузі цифрової гуманітаристики, архівістів, музеєзнавців, розробників культурної політики та фахівців з управління цифровими колекціями, що займаються проблемами збереження та репрезентації нематеріальної культурної спадщини

Ключові слова: метадані; пара-дані; міжнародні стандарти; гуманітаристика; артефакти; літописи