

CULTURAL HERITAGE IN THE DIGITAL ENVIRONMENT: A COMPARATIVE ANALYSIS OF BULGARIAN AND INTERNATIONAL MODELS

Angel Dimitrov Georgiev

University of Library Studies and Information Technologies, Bulgaria, a.d.georgiev@unibit.bg

ORCID ID: 0009-0006-2545-502X

Pamela Krasimirova Deleva

University of Library Studies and Information Technologies, Bulgaria, p.deleva@unibit.bg

ORCID ID: 0009-0006-9818-4873

Gabriela Georgieva Krastanova

University of Library Studies and Information Technologies, Bulgaria, g.krastanova@unibit.bg

ORCID ID: 0009-0004-3132-6211

Abstract: The purpose of this paper is to present a comparative analysis of Bulgarian and foreign models for the digitalization of cultural heritage, focusing on their characteristics, advantages, limitations, and future development opportunities. The study aims to examine how digital technologies influence the preservation, management, accessibility, and dissemination of cultural resources in different institutional and technological environments. Special attention is given to the transformation of traditional cultural heritage into a digital information resource that can support education, scientific research, cultural communication, and public engagement. The research applies a comparative analysis approach, examining digitalization practices in Bulgarian cultural institutions and European digital heritage initiatives. The study analyzes digital collections, information environments, interoperability standards, metadata structures, and examples of integrated digital platforms. The methodology includes an analysis of existing practices in libraries, museums, archives, and research organizations, as well as a comparison between decentralized national approaches and coordinated international models for digital cultural heritage management. The analysis shows that the Bulgarian model is mainly decentralized, with libraries, museums, archives, and research organizations independently developing and managing their own digital collections. This approach contributes to the preservation of valuable regional cultural resources and supports the presentation of local history and identity. However, the lack of sufficient coordination, unified standards, and interconnected digital infrastructures creates challenges related to fragmentation, accessibility, data exchange, and the long-term sustainability of digital resources. In contrast, foreign and European models demonstrate a higher level of integration through common standards, interconnected platforms, and shared digital infrastructures, such as Europeana and the Common European Data Space for Cultural Heritage. These initiatives illustrate the importance of cooperation between cultural institutions, technological compatibility, and the development of unified approaches that enable wider access to millions of digital cultural objects from different countries and organizations. The research highlights the growing importance of advanced digital technologies, including high-quality digital copies, three-dimensional models, and digital twins of cultural objects. These technologies provide new possibilities for preservation, restoration, virtual exhibitions, cultural tourism, and innovative educational practices. Digital representations can also serve as an additional protection mechanism in situations involving natural disasters, armed conflicts, or other risks affecting physical cultural heritage. The results demonstrate that digitalization transforms cultural heritage from a static collection of preserved objects into a dynamic and accessible knowledge resource. Although digital copies cannot replace the authenticity, uniqueness, and material value of original cultural objects, they provide significant opportunities for preserving information, supporting academic research, and ensuring access for future generations.

The study recommends strengthening cooperation between Bulgarian cultural institutions, introducing common digital standards, improving interoperability between existing platforms, and developing sustainable strategies for the long-term preservation and accessibility of digital cultural resources. Greater integration with European digital initiatives would contribute to increasing the visibility of Bulgarian cultural heritage at an international level. The research includes examples related to digital collections, digital twins, virtual exhibitions, and international practices for protecting cultural heritage through digital technologies. These examples demonstrate that successful digital transformation requires not only technological solutions but also institutional cooperation, effective management strategies, and continuous development of digital competencies among cultural professionals.

Keywords: Cultural heritage; digitization; digital collections; libraries; information environment.

1. INTRODUCTION

The development of digital technologies has significantly transformed the ways in which cultural heritage is preserved, managed, presented, and accessed by society. Traditional access to manuscripts, archival documents, rare books, museum artifacts, and photographic collections was historically connected with physical visits to

cultural institutions. Today, digital technologies enable these resources to be represented within virtual environments, providing opportunities for wider public access, education, and scientific research. Digital cultural heritage should not be understood merely as the process of scanning documents or creating digital images of museum objects. Contemporary approaches define digitization as the creation of an organized digital environment in which cultural objects are described, structured through metadata, connected with related information resources, and made available for various forms of use. Therefore, digitization represents not only a technological process but also a transformation in the management and dissemination of cultural knowledge. In Bulgaria, the digitization of cultural heritage has developed gradually through initiatives implemented by libraries, museums, archives, and research organizations. Many institutions have created valuable digital collections based on their own technical capabilities, financial resources, and professional expertise. This process has contributed to the preservation and accessibility of significant cultural resources; however, it has also resulted in a relatively decentralized digital environment. Different institutions frequently use different systems and methods for describing and presenting digital content, which limits interoperability and creates isolated digital repositories. In contrast, European models increasingly focus on integration, common standards, and interconnected digital ecosystems. Initiatives such as Europeana and the Common European Data Space for Cultural Heritage demonstrate a transition from isolated digitization projects toward coordinated digital infrastructures (European Commission, n.d.). Within these models, museums, libraries, and archives preserve their institutional identity while contributing their digital resources to shared platforms. The objective of this study is to analyze the differences between Bulgarian and international approaches to cultural heritage digitization. The research examines the organizational characteristics of digital heritage management, the role of interoperability and common standards, and the opportunities created by digital technologies such as digital twins, three-dimensional models, and the reuse of digital cultural content.

2. MATERIALS AND METHODS

The study applies a qualitative comparative research methodology aimed at examining Bulgarian and international models of cultural heritage digitization. The research materials include official institutional documents, strategic policy papers, digital heritage platforms, and examples of implemented digitization projects. The analysis includes documents published by the Ministry of Culture of the Republic of Bulgaria, European initiatives related to digital cultural heritage and examples from museums, libraries, and archives. A comparative approach was used to identify similarities and differences between the Bulgarian model and European practices. The Bulgarian case was analyzed through the development of institutional digital collections and national efforts toward establishing unified standards for digitization. The international comparison focused mainly on European digital heritage initiatives, particularly Europeana and the Common European Data Space for Cultural Heritage. The study also applies analytical interpretation of technological developments related to digital preservation, including three-dimensional digitization, digital twins, metadata integration, and opportunities for reuse of digital cultural resources. The methodology allows evaluation of both technological and organizational aspects of digitization and provides a basis for identifying future directions for the development of digital cultural heritage management.

3. RESULTS

The analysis showed that Bulgarian cultural institutions have achieved significant progress in creating digital collections and improving access to cultural resources. Libraries, museums, and archives have successfully digitized valuable materials, including manuscripts, historical documents, photographs, and museum collections. However, the results indicated that the Bulgarian model remains largely decentralized. Digital collections are often developed independently by individual institutions, resulting in differences in technological solutions, metadata structures, and access mechanisms. This situation creates digital fragmentation and limits the possibility of integrated searching across different collections. The study found that European digital heritage models provide a more coordinated approach. Platforms such as Europeana demonstrate the advantages of connecting diverse cultural resources through common standards and interoperable systems. This approach enables users to access materials from different institutions and countries through a unified digital environment. The results also demonstrated that modern digitization extends beyond preservation. Digital cultural objects can be reused in education, scientific research, virtual exhibitions, tourism applications, and creative industries. The development of digital twins and three-dimensional models provides additional opportunities for documenting cultural objects in detail and supporting future conservation and restoration activities (**European Commission, n.d.**).

Furthermore, the analysis showed that digital preservation provides an additional layer of protection for cultural heritage. While digital copies cannot replace original artifacts, they preserve important information about their appearance, structure, and condition.

4. DISCUSSIONS

The findings demonstrate that the main difference between Bulgarian and international models is not related primarily to technological capacity but to the organization and integration of digital resources. The Bulgarian cultural heritage sector possesses significant collections and professional expertise. However, the effectiveness of digitization depends on the ability of institutions to cooperate, apply common standards, and develop interconnected information systems. European experience indicates that successful digital heritage management requires a shift from institution-centered digitization toward ecosystem-based approaches. Digital objects gain greater value when they can be discovered, connected, and reused beyond the institution that originally created them. The growing importance of digital twins and advanced digital representations introduces new possibilities for cultural heritage preservation. These technologies support not only documentation but also research, education, and public engagement. Nevertheless, digital technologies should be considered complementary tools rather than replacements for original cultural objects. The historical experience of protecting cultural collections during periods of crisis, such as the evacuation of British museum collections during the Second World War, demonstrates the continuing need for preservation strategies. While physical relocation was historically the primary solution, digital preservation now provides an additional mechanism for safeguarding cultural memory (**European Commission, n.d.**). Recent developments also demonstrate that digital cultural heritage is increasingly recognized not only as a preservation tool but also as a valuable cultural and economic asset. The growing market for high-quality digital reproductions illustrates how advanced digitization technologies can create new opportunities for cultural institutions, collectors, and creative industries while maintaining the authenticity and protection of original artworks (**Associated Press, 2025**).

5. CONCLUSIONS

The study concludes that digital cultural heritage represents a strategic and rapidly evolving field that integrates the preservation of cultural assets with accessibility, knowledge creation, technological innovation, and public engagement. Digital transformation has fundamentally changed the way cultural resources are preserved, documented, managed, and disseminated, enabling broader access to historical collections and fostering new opportunities for research, education, and cultural participation. The future development of digitization will depend not only on the increasing number of digitized objects but also on the quality of metadata, interoperability between digital repositories, long-term digital preservation strategies, discoverability of resources, and their potential for reuse in educational, scientific, and creative contexts. The comparative analysis demonstrates that Bulgaria has made significant progress in the development of digital collections through the efforts of libraries, museums, archives, universities, and research institutions. Nevertheless, additional efforts are required to strengthen cooperation among cultural institutions, improve interoperability between institutional repositories, adopt internationally recognized metadata standards, and ensure the integration of national digital resources into European digital infrastructures. Expanding participation in international initiatives and collaborative projects will further enhance the visibility and accessibility of Bulgaria's cultural heritage within the global digital environment. Digital technologies provide unprecedented opportunities for creating sustainable and innovative models for the preservation, management, and dissemination of cultural heritage. The integration of emerging technologies, such as artificial intelligence, semantic web technologies, linked open data, and immersive digital environments, has the potential to improve the organization, interpretation, and user experience of digital cultural resources. Through the implementation of common standards, continuous technological innovation, institutional collaboration, and international cooperation, digital cultural heritage can become an increasingly accessible, interoperable, and valuable resource that supports education, scientific research, cultural tourism, lifelong learning, and the preservation of cultural identity for future generations.

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