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INNO-CULT: DIGITIZATION OF CULTURAL HERITAGE AS A TOOL FOR SUSTAINABLE DEVELOPMENT AND SOCIAL INCLUSION

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Abstract: In the face of global challenges such as climate change, demographic changes and social inequality, sustainable development requires innovative solutions, including the digitalization of cultural heritage. The INNO-CULT project proposes to integrate modern digital technologies into the process of conservation, seminars and promotion of cultural resources, fully aligned with the objectives of the European Strategy for Heritage in the 21st Century (Strategy 21 of the Council of Europe). The project includes the development of a multilingual, interoperable and sustainable digital platform, which provides open access to cultural artefacts and educational resources, such as augmented reality (AR), 3D visualization and automatic text analysis. A key element of the project is the involvement of the local population of the regions and the scientific community through participation in innovative events, digital heritage laboratories and the creation of cultural and tourist routes. These initiatives not only contribute to the development of sustainable cultural ecosystems, but also stimulate social inclusion, supporting cultural identity and accessibility for diverse population groups. The article discusses the model of digital transformation of cultural heritage as a powerful tool for territorial, social and economic development. It also makes recommendations for strengthening transnational cooperation in the field of culture and education, based on the principles of openness, sustainability and inclusion, as key aspects of the Council of Europe's Strategy 21.

Keywords: *digitization of cultural heritage, sustainable development, European Heritage Strategy for the 21st Century, Strategy 21, social inclusion, digital technologies, INNO-CULT, transnational cooperation*

Introduction

European countries are facing new challenges - climate change, demographic shifts, uneven territorial development, and accelerated digitalization. These processes require a reconsideration of the role of cultural heritage: from a matter of conservation to a resource for innovation, education, regional development, and social cohesion. In accordance with the European Strategy for Cultural Heritage in the 21st Century (Strategy 21) [1], heritage is viewed as part of a living socio-economic fabric, not as a static archive of the past. For the Republic of Moldova, which possesses a rich tangible and intangible heritage but lacks a systemic digital infrastructure, modernizing approaches, engaging local communities, and integrating into European initiatives are particularly urgent. Many cultural resources remain inaccessible or are at risk of disappearing due to demographic processes and youth migration. This increases the need for digital tools capable of documenting, interpreting, and disseminating cultural heritage.

The INNO-CULT project and the Inno4Cult platform offer a model that integrates digital technologies, educational programs, and regional development. The platform covers all six regions of Moldova and connects them with the border areas of Romania and Ukraine. Based on the Triple Transition concept [2] - green, digital, and social transitions - the model views cultural heritage as a resource for sustainable development, scientific collaboration, and strengthening social inclusion.

At the strategic level, the project is based on the documents "Moldova 2030" and "Strategy for Culture and Heritage 2025-2035" [3], which recognize the need for digital transformation of the sector. It is also aligned with the priorities of European programs – Horizon Europe, Creative Europe

[4], INTERREG [5] – by creating opportunities for interoperability, open data, and inclusion in European innovation networks.

INNO-CULT thus creates a unified ecosystem that unites national strategies, regional plans, and international initiatives, offering a modern model for the digitalization and sustainable development of cultural heritage.

National and regional strategies, European programs and best practices

An analysis of Moldova's strategic documents reveals that digitalization is recognized as a key tool for modernization, yet its development in the cultural sector remains fragmented. The "Moldova 2030" Strategy emphasizes digital literacy, service modernization, and support for innovation, paving the way for projects like Inno4Cult. The new "Strategy for Culture and Cultural Heritage 2025–2035" for the first time systematically defines the importance of digital archives, virtual museums, augmented reality technologies, and local community participation.

Regional strategies focus on cultural tourism but under-integrate digital mechanisms. INNO-CULT acts as a bridge, offering regional administrations tools for implementing digital cultural initiatives. In the European context, the platform is aligned with the trends of Horizon Europe (digital humanities, digital twins of monuments), Creative Europe (digital storytelling, innovative cultural platforms), and INTERREG NEXT (shared routes, virtual museums, digital labs). Thanks to its interoperability, Inno4Cult can connect with Europeana [6], Cultural Gems [7], Heritage Innovation [8], and European S3 platforms, integrating Moldova's development regions, according to the strategy [9], into transnational innovation chains.

European best practices – Europeana, SmartCulture, and CINECA's digital twins – confirm that digitalization enhances the value of heritage, improves its accessibility, and stimulates scientific collaboration. Inno4Cult, integrating with Cluster 2 [10], proposes adapting these models to the Moldovan context, creating a modern digital cultural infrastructure.

The Triple Transition as a methodological basis for the digital transformation of cultural heritage

The Triple Transition concept - green, digital, and social transitions - has become a key framework for European sustainable development and smart specialization policies [11]. Applying this approach to cultural heritage allows us to view it as a dynamic resource capable of stimulating innovation, regional development, and social inclusion. For Moldova, where heritage potential is insufficiently integrated into economic and educational processes, Triple Transition offers opportunities to connect cultural resources with the country's modernization.

1. Green Transition: Cultural Landscapes and Environmental Sustainability

The Green Transition integrates natural and cultural heritage, creating environmentally responsible models of territorial management. For Moldova, where migration, climate change, and infrastructure degradation are eroding traditional links between nature and culture, Inno4Cult's digital tools enable:

- document natural and cultural complexes;
- create virtual reconstructions of threatened objects;
- develop ecotourism routes;
- promote environmental knowledge based on traditional practices;
- support the Moldova-Romania-Ukraine cross-border green routes.

Thus, the green component enhances the sustainability of cultural landscapes and engages citizens in environmentally oriented heritage.

2. Digital Transition: Technologies as the Infrastructure of a New Cultural Policy

The digital transition views heritage as an element of big data, scientific research, and educational ecosystems. Key areas of implementation on the Inno4Cult platform include:

- creation of a multilingual, interoperable digital infrastructure;
- integration of archives, 3D models, multimedia, ethnographic data and GIS maps;
- use of AR/VR, digital twins [12] and interactive routes;
- implementation of automated analysis of texts and images;
- modernization of museums and archives, development of digital competencies.

Thus, the digital transition forms a modern scientific and educational base for the cultural sector.

3. Social Transition: Citizen Participation and Strengthening Communities

Social transition means a shift from the "heritage as object" model to "heritage as practice." Within the INNO-CULT framework, this is expressed through:

- the work of digital laboratories involving schoolchildren, students, bearers of traditions and museum workers;
- inclusive educational formats (audio guides, adapted interfaces, multimedia);
- development of local cultural entrepreneurship;
- cross-border cooperation between residents of Moldova, Romania and Ukraine.

Thus, social transition transforms cultural heritage into a mechanism for strengthening identity and social cohesion.

4. Interconnection of transitions: the integrative model INNO-CULT

Three transitions form a single system, where:

- green transition ensures sustainability of landscapes and practices;
- digital - creates tools for analysis and dissemination;
- social - forms sustainable communities and institutional connections.

This model transforms heritage from a status of “protected resource” to a role as a factor in territorial and social development.

5. The Importance of Triple Transition [13] for Moldova and the Region

The use of Triple Transition helps to:

- modernization of cultural institutions;
- development of skills and educational programs;
- formation of sustainable regional communities;
- support for tourism and creative industries;
- integration with European innovation structures.

For Moldova, Romania and Ukraine, the model creates a basis for cross-border greenways, shared digital archives and sustainable cooperation.

Inno4Cult as an Integration Ecosystem: Architecture, mechanisms and cooperation

The Inno4Cult platform is more than just a digital archive, but a multi-layered ecosystem uniting culture, education, tourism, science, and civic engagement. It serves as a tool for regional and transnational integration and is built on the principles of Triple Transition.

1. Platform architecture

Inno4Cult is based on four fundamental principles:

- multilingualism - accessibility for Moldova, Romania, Ukraine and international audiences;
- interoperability – compatibility with Europeana, Cultural Gems and local systems;
- openness - adherence to FAIR principles [14] and the use of open data;
- sustainability - long-term development, partnerships and regular content updates.

The platform includes key modules:

1. Digital heritage archive - images, 3D models, audio, ethnography, maps.
2. Educational module – courses, lessons, virtual tours, multimedia.
3. Digital tourist routes - GIS, AR, historical and cultural trails.
4. Research tools - analytics, visualization, API.
5. Civic participation module - storytelling, crowdsourcing, local content.

This architecture allows for the combination of tangible and intangible heritage in a single digital ecosystem.

2. Mechanisms of regional and international cooperation

The platform facilitates horizontal and vertical connections between institutions, regions, and countries. Within Moldova, it unites six regions, facilitating data exchange, joint projects, and the development of local initiatives. Internationally, Inno4Cult supports cooperation with Romania and Ukraine through:

- joint digital routes and cultural corridors;
- general archives and ethnographic collections;
- participation in the Creative Europe, Horizon Europe, INTERREG NEXT programs.

This model creates a space for open cultural exchange and facilitates Moldova’s inclusion in European innovation networks.

3. Digital Heritage Labs [15] and educational initiatives

Local digital labs are becoming growth points for cultural ecosystems. They provide equipment, training, consultation, and opportunities for using digital technologies in heritage documentation. Particular attention is paid to:

- schools and universities,
- young people from rural areas,
- museums and libraries,
- ethnocultural communities.

The labs strengthen regional competencies, create content for the platform, and stimulate the development of local entrepreneurship.

4. Innovative development and economic potential

Inno4Cult fosters the development of new markets: digital archives, VR/AR content, educational platforms, multimedia production, creative initiatives, and tourism. The platform's innovative potential is enhanced by:

- integration of data into research [16],
- creation of digital twins of objects,
- opportunities for startups,
- cooperation with local administrations and NGOs.

The platform becomes an instrument for sustainable regional modernization.

Expected effects and impact assessment

The combination of digital services, educational modules, and transnational cooperation allows us to predict the project's significant cultural, social, and economic impact—in both the short and long term.

1. Cultural impact

- Preservation of heritage.

Digitalization reduces the risk of asset loss and creates archives, 3D models, and digital twins, which are particularly relevant for rural and remote areas of Moldova.

- New interpretations.

AR/VR technologies, multimedia and interactive routes shape modern ways of perceiving cultural objects.

- Availability.

The platform provides access to museums, archives, and collections for people with limited mobility, schoolchildren, the diaspora, and researchers.

2. Social impact

- Citizen participation.

Crowdsourcing, digital labs, and educational programs engage residents as content creators, strengthening their connection to local heritage.

- Inclusiveness.

Adaptive interfaces and multimedia make it possible to include vulnerable groups: people with disabilities, ethnic minorities, young people from rural areas, and migrants.

- Social unity.

Documenting local histories and traditions increases social cohesion and strengthens identity.

3. Economic impact

- Growth of cultural tourism.

Virtual tours, AR maps, and digital routes are creating new tourism products, contributing to regional development.

- Development of creative industries.

Digital content, educational services, VR applications, animation, and crafts are creating jobs for young people.

- Investment attractiveness.

Data integration and sustainable digital solutions make regions more competitive in European programmes.

4. Territorial impact

- Reducing regional imbalances.

Six regions of Moldova are receiving equal access to digital infrastructure, educational resources, and project-based tools.

- Cross-border integration.

Joint routes and collections with Romania and Ukraine strengthen cultural ties and stimulate international tourism.

5. Institutional and scientific impact

The platform facilitates the modernization of museums, archives, and libraries, strengthens scholarly connections, and provides a foundation for new research. FAIR principles ensure data quality, while a flexible architecture ensures the sustainability and reproducibility of the project.

6. Risks and barriers

The main challenges are: a shortage of specialists, labor migration, uneven levels of digital literacy, and institutional fragmentation. These risks can be overcome through sustainable funding, training [17], and cross-sectoral collaboration between universities [18], public administrations, NGOs [19], and the business community.

Conclusion and recommendations

INNO-CULT and the Inno4Cult platform represent a modern model for integrating cultural heritage, digital technologies, and sustainable development. Their impact extends beyond simple digital preservation, shaping territorial, social, and economic change, particularly relevant for Moldova and neighboring regions. The analysis showed that the project:

- strengthens cultural identity and increases accessibility of heritage;
- stimulates citizen participation and social inclusion;
- promotes the growth of creative industries and tourism;
- reduces regional imbalances and strengthens cross-border cooperation;
- provides a modern scientific and educational infrastructure.

Recommendations

1. Strengthening the Triple Transition: developing green tourism, expanding digital services, supporting citizen participation.
2. Education and science: online courses, digital laboratories, advanced training for cultural workers.
3. Transnational cooperation: shared digital content, participation in INTERREG, Horizon Europe, Creative Europe.
4. Sustainable finance and infrastructure: cloud solutions, open standards, partnerships with the private sector.
5. Monitoring and evaluation: regular analysis of cultural, social and economic impacts.
6. Inclusiveness and openness: multilingual support, adaptive interfaces, integration of future technologies.

INNO-CULT has the potential to become a central digital infrastructure for cultural and educational initiatives in Moldova and the region. With sustained support, it can make a long-term contribution to social, economic, and cultural development, serving as a model for countries with similar needs.

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