Balancing openness and sensitivity in archaeological data: European frameworks and digital heritage management

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***Abstract* — The digitalization of archaeological research has intensified the need to align open data principles with the ethical and legal frameworks for handling sensitive information. This work explores how the current EU frameworks address these tensions and examines their implementation through recent heritage projects. We focus on two case studies: the EU-funded ARGUS project and the SHAReLAND project at Roma Tre University. Among their objectives is the effort to balance openness with data protection. The paper highlights the importance of shared standards and cross-platform integration in building inclusive data infrastructures for cultural heritage.**

Keywords—Archaeological heritage, data openness, data sensitivity, interoperability, open science, citizen science.

I Introduction

This paper is organized as follows: after a brief introduction regarding the two case studies, section II outlines the state of the art; section III analyzes how key European policy frameworks can be applied to archaeological datasets; section IV addresses challenges around openness and data sensitivity in the management of archaeological research data; section V presents practical implementations in ongoing projects; in section VI conclusions are given.

In recent years, the openness of scientific data has established itself as one of the fundamental pillars of European research, actively promoted by policies, initiatives, recommendations as well as programs such as Horizon Europe under the principle of 'open as possible, closed as necessary' [1]. In the field of cultural heritage, and more specifically in the case of archaeological data, this openness comes into tension with the need to protect certain types of sensitive information, such as the precise location of vulnerable sites or the authorship of data from past research.

The European project ARGUS (Smart and remote monitoring for cultural heritage preservation) lies at the crossroads between these two vectors. Its main objective is to develop an advanced digital infrastructure for the monitoring and preventive preservation of remote heritage assets, based on multimodal digital models and intelligent analysis systems. In this framework, archaeological data management must address interoperability and reuse, but also ethical, legal, and technical criteria that guarantee heritage protection. In the recent past, EU funded research projects and European research networks have assessed the complexities of archaeological data management, addressing the issues of interoperability, ethical reuse and long-term preservation. Some initiatives [2][3][4] have helped define standards and ontologies that underpin many of our methodological choices. To this end, OpenAIRE [1] was established to provide a permanent, open scholarly communication infrastructure that supports European research. We argue that the digital era has created the potential and the imperative to adopt shared standards and cross-project data integration models. The growing potential of online data integration across multiple archaeological projects has made the need for standardization more pressing than ever, turning what was once an abstract objective into a concrete requirement for cross-disciplinary research [5]. This article proposes a reflection, based on the experience of the ARGUS project, on the possibilities and limits of opening archaeological data in the incoming implementation of the SHAReLAND platform for the collaborative management of archaeological landscape data.

Recent developments within ARGUS, such as the creation and development of the Panoptes ontology [6], have advanced the semantic and operational modelling of cultural assets through predictive and sensor-integrated digital twins. However, we need a complementary reflection on the ethical and regulatory dimensions of data openness, especially in the context of archaeological data and community-sensitive information.

The main contributions of this paper are as follows:

- It explores the tension between data openness and sensitivity in cultural heritage
- It analyzes how key European policy frameworks can be applied to archaeological datasets
- It presents the ARGUS and SHAReLAND case studies as involving the ethical management of sensitive cultural data
- It proposes a set of solutions for balancing openness and protection in archaeological data management

[1] https://www.openaire.eu/

- It reflects on the integration of local knowledge and the concept of authorship as essential components of digital infrastructures.

II State of the Art

The preservation of cultural heritage today requires addressing not only material decay, but also the impact of climate change, human impact, and the challenges of monitoring remote or vulnerable sites affecting the holistic preservation of cultural assets and historical landscapes.

In this context, the European Union has promoted a new generation of projects that combine advanced digital technologies, environmental awareness, and interdisciplinary collaboration, [2]Within this framework ARGUS is one of four Horizon Europe-funded initiatives selected under the call HORIZON-CL2-2023-HERITAGE-01-01, which supports innovative and non-invasive methods for heritage documentation and preventive conservation. Together, the projects ARGUS[3], NERITES[4], Cheminova[5] and iPhotoCult[6], funded within the same call, constitute a collaborative network named Green Heritage Cluster, and represent a cross-section of cutting-edge research trends in the field. This cluster is not merely a strategic alliance—it also reflects the evolving direction of European heritage research: open, collaborative, data-driven, and sustainable. This cluster is not merely a strategic alliance—it also reflects the evolving direction of European heritage research: open, collaborative, data-driven, and sustainable.

Each project brings a distinct focus and cutting-edge methodologies. Despite their diverse scopes—ranging from terrestrial and architectural to underwater and mobile heritage—these projects share common values: non-destructive methods, sensitivity to environmental impact, and the use of digital tools for risk prevention and public engagement.

A. A shared collaborative research ecosystem: the Green Heritage Cluster

The Green Heritage Cluster functions as a space of convergence for these initiatives. It encourages the sharing of technologies and methodologies and the alignment of datasets, pilot site infrastructures, and ethical frameworks for data openness and reuse. Projects within the cluster like ARGUS are increasingly integrating environmental data from open-access European, national and local platforms, and also the so-called phygital archives, in order to model climate-related and environmental risks. This runs in parallel with the structured processing and sharing of archaeological and cultural asset data and enhances the capacity for cross-project analysis and monitoring in the long term. Such integrated frameworks enable the transformations of heterogeneous data into standardized resources for heritage preservation [7].

The formation of the cluster also reflects a broader EU strategy: to strengthen the long-term interoperability and reusability of cultural heritage data, while fostering knowledge exchange between institutions, researchers, and citizens. Each project, while retaining its autonomy, contributes to this larger vision.

Within the Cluster—and particularly within each individual project—this vision is implemented through the integration of environmental data from open EU, national, and local platforms, as well as from phygital archives. Each project, while maintaining its autonomy, contributes meaningfully to this collective effort. Within ARGUS, these data sources support GIS-based modelling of climate and environmental risks, contributing to a more consistent assessment of the threats affecting cultural heritage. This is complemented by the sharing of archaeological data and detailed information on tangible cultural assets.

III European Regulations and Policy Framework

The management of archaeological data in the European Union sits in the intersection of legal obligations and strategic aspirations. The digital technologies are increasingly shaping the ways in which cultural heritage is accessed and preserved. European policies have evolved to support both openness and responsible use of cultural information. For projects like ARGUS, this means navigating a regulatory landscape that both encourages innovation and imposes safeguards.

B. A foundation of protective legislation

At the core of the EU legal framework lies an emphasis on the protection of cultural heritage from illicit circulation and destruction. Key legislative texts underscore this commitment: Directive 2014/60/EU ensures that cultural goods unlawfully removed from a Member State can be reclaimed [8]. Regulation (EC) No. 116/2009 [9] and Regulation (EU) 2019/880 [10] establish controls on the export and import of cultural goods.

Simultaneously, the EU promotes the digital transformation of cultural heritage institutions, with Open Science that has become a priority for the EU and the standard approach within its research and innovation funding programmes, since it enhances the quality, efficiency, and responsiveness of research [7]. Legislation here focuses on increasing accessibility, encouraging reuse and protecting intellectual property:

The EU supports open access through key instruments like the Open Data Directive [11], the Copyright Directive [12], which enables digital reuse and text mining; and an EU Recommendation on scientific information [13] that supports long-terms preservation. The adoption of EU calls for the employment of FAIR (Findable, Accessible, Interoperable,

[2] HORIZON-CL2-2022-HERITAGE-01-08 Effects of climate change and natural hazards on cultural heritage and remediation and HORIZON 2020 -topic LC-CLA-04-2018- Resilience and sustainable reconstruction of historic areas to cope with climate change and hazard events

[3] www.argus-project.eu/

[4] https://nerites.eu

[5] https://cheminova.eu/

[6] https://iphotocult.eu/

[7] https://www.openaire.eu/ec-policies-and-mandates

Reuseable) principles to enhance data sharing and reuse by both researchers and machines should be added[8].

In terms of data architecture and privacy, two additional regulations frame how CH projects like the ones presented here handle this information. The INSPIRE Directive promotes interoperability in geospatial data infrastructures across borders and systems [14]. The General Data Protection Regulation (GDPR) protects personal information. We must anonymize or secure any personal data that we collect or process, like information linked to stakeholders or sensor-captured imagery [15].

C. *Beyond compliance: Strategic orientations for digital heritage*

In addition to binding legislation, the EU has articulated a series of strategic initiatives that shape the vision for digital heritage management. Moreover, initiatives such as SEADDA[9] bring together broad communities of archaeologists and digital specialists who work closely to secure the future of archaeological data, within Europe and beyond [16]. These policies and initiatives, although not mandatory, serve as guiding principles for projects like ARGUS.

The European Data Space for Cultural Heritage, framed by Recommendation 2021/1970, envisions a federated, open and high-quality digital infrastructure [17]. The project ARGUS contributes to this ambition through the creation of digital twins and rich metadata records that can be integrated into pan-European digital platforms. Moreover, the launch of the European Collaborative Cloud for Cultural Heritage (ECCCH) [18] initiates the EU target to connect cultural heritage institutions and professionals across the EU through the development of specific digital collaborative tools for the sector while removing barriers for smaller and remote institutions. Through the ECHOES project[10], a shared digital platform will be developed to offer heritage professionals and researchers access to data, scientific resources, training, and advanced digital tools tailored to their specific needs. The European Framework for Action on Cultural Heritage (2018) encourages cross-sectorial collaboration, data-driven decision-making and participatory governance [19][20][21]. Finally, the Council of Europe conventions—particularly the Valletta Convention [22], Granada Convention [23], European Landscape Convention [24] and Faro Convention [25]—promote in-situ preservation and the rights of citizens to engage with their heritage.

D. *A balanced approach: openness, protection and ethical care*

The European regulatory framework demands openness and protection but also calls for balance. The ARGUS project embodies this design of a data governance model that is: a) Open: where transparency, reuse and accessibility promote collective knowledge. b) Filtered: where access restrictions protect sensitive content. c) Interoperable: complying with established standards to ensure integration across systems. And d) Ethically grounded: recognizing the provenance of data, respecting privacy and involving the communities.

IV Archaeological Data: Issues of Openness and Sensitivity

Some of the case studies selected by ARGUS involve archaeological sites and landscapes, such as the Greek island of Delos, the medieval castle of Schenkenberg in Switzerland, and the Monti Lucretili landscape in Italy. Archaeological data present specific characteristics and needs, requiring a careful balance between openness for research and public engagement, and sensitivity to issues such as site protection, cultural heritage rights, and ethical considerations.

The "sensitivity" of archaeological data refers to the fragility, vulnerability, and potential ethical, social, political, or cultural impact that may result from the handling, dissemination, or interpretation of such data. Archaeological data are not ethically neutral and require careful contextualization, safeguards to ensure both security and cultural sensitivity, and appropriate governance mechanisms [26][27][28]. As a cultural mediator, the archaeologist bears the responsibility of contributing to a multidisciplinary and, above all, inclusive approach to data management— one that considers not only the technical aspects of data collection and dissemination, but also, and more importantly, its social and ethical dimensions. Sensitivities may arise not only from the nature of the information itself, but also from the identity and positionality of those who have produced it. This is particularly relevant in the case of oral histories and interviews, which often involve the gathering of personal and sensitive data. Equally important is the recognition and protection of authorship behind the production of archaeological information, both in the past and in the present. Safeguarding provenance is essential not only for ensuring the traceability of legacy data, but also for enabling critical source analysis and fostering transparency in the interpretative process, which is fundamental to the construction of reliable and accountable narratives (on the topic of authorship and authority, see [29], among others). The situation becomes even more complex when data are inherited from pre-existing digital databases and current platforms. In such cases, questions often arise regarding the original context of data creation, the accuracy and completeness of associated metadata, and the terms of use or licensing agreements under which the data were originally shared. Addressing these challenges requires a clear framework for data stewardship that balances accessibility with ethical responsibility, and acknowledges the diverse stakeholders involved in the creation, curation, and reuse of archaeological knowledge.

Another dimension of the sensitivity of archaeological data - the main one that even today makes numerous archaeological data not freely accessible to anyone - is the risk of archaeological sites being subjected to looting, deliberate

[8] https://www.go-fair.org/fair-principles/

[9] https://www.seadda.eu/

[10] *European Cloud for Heritage OpEn Science* - https://www.echoes-eccch.eu/

damage, or illegal trade in artefacts. In the past, to overcome the stagnant situation, this issue was addressed using spatial generalization techniques. Areal mapping, rather than assigning precise absolute coordinates, or spatial generalizations have been adopted in projects such as ARIADNE /ARIADNEplus[11], Open Context[12], tDAR[13], and Carpetania Romana Rustica[14], aiming at privacy and preservation while offering yet effective approach to visualizing archaeological data.

We feel that this raises an important question: are safety and protection truly at odds with the openness of archaeological data? In an open, participatory, and bottom-up approach to research, keeping archaeological data locked away may risk deepening the divide between specialists and the stakeholders and local communities to whom cultural heritage ultimately belongs. Such an approach can complicate genuine collaboration—which should be grounded in accessibility and transparency—and reinforce a traditional, top-down model of heritage protection. In doing so, it risks missing the opportunity to engage communities in actively caring for and co-managing their cultural heritage (Faro Convention [25]).

V Implementation in Ongoing Projects

The following section shows how these theoretical principles have been implemented in the ARGUS and SHAReLAND projects. A compelling example of such an approach to archaeological data sharing is the SHAReLAND project, an ongoing initiative at Roma Tre University. Currently being developed within the Landscape and Digital Archaeology teaching program, SHAReLAND aims to create a participatory digital environment for collecting, sharing, and, most importantly, reusing data on archaeological landscapes. This goal is pursued through a GeoServer-based platform primarily designed for the student community, with a strong emphasis on training and tutoring. The ultimate goal of the project is to create a dynamic knowledge base that connects otherwise isolated research efforts, fosters open and collaborative practices in archaeology, and actively involves both young generations of researchers and the local communities inhabiting the landscapes under study [29] [30].

Within the SHAReLAND project, we explored potential solutions for achieving a balance between open access to data and the need for safeguarding sensitive information. As mentioned above, our approach involves implementing audience-specific access filters, whereby more detailed information is made available to users like archaeology students or researchers through a registration process on the platform. Different present-day projects adopt this solution [26], distinguishing between different user roles with varying access and editing rights. In our case, for instance, general public users are presented with simplified views, avoiding unnecessary or overly technical information, while tutors or supervisors are granted editing permissions to review and verify data submitted by students.

To implement the balance between openness and sensitivity, both projects adopt a range of complementary strategies:

- Access control mechanisms: tiered user roles and credential systems restrict data visibility based on user profiles
- Spatial generalization: aerial or approximate locational data protect vulnerable archaeological sites from looting
- Anonymization techniques: for oral histories or community co-created data with personally identifiable information
- Recognition of authorship and provenance: to ensure intellectual transparency, traceability and ethical reuse of legacy datasets while providing contextual signs for accessing reliability and quality of the data.

The development of a robust archaeological community of practice, indeed, necessitates the involvement of registered and clearly identifiable individuals who can exchange ideas and enrich one another through shared research. At the same time, the principle of openness—which, as Costa et al. [31] note, typically entails public accountability, transparency of practice, and plurality of opinions—should also be structured to deliver meaningful benefits to non-academic communities.

Local communities should play a role as co-leaders in the shared construction of knowledge. Participatory tools such as living labs, focus groups, and workshops with the wider public represent effective ways to start a structured and collaborative dialogue aimed at the joint definition of operational strategies [32]. Such practices, if well conducted, not only foster social inclusion, but also contribute to enriching the knowledge pool with local knowledge that is often not formalized, but of great relevance. Indeed, alongside the use of technologies—such as dedicated sensors—to remotely monitor specific cultural heritage sites, local inhabitants themselves can act as 'sensors' of wider environmental changes and as indicators of the dynamics unfolding in their territory [32], like in the CITiZAN project[15]. Today, the widespread ability of individuals to generate continuous, direct, and even geolocated digital data should be harnessed for these purposes and enhanced through effective joint governance.

In this framework, integrated archaeological data management can and should also include information collected directly from local communities. Digital technologies, in particular mobile GIS systems, offer flexible and accessible tools that allow the direct input into databases of geo-referenced data collected 'from the bottom', through participatory mapping and on-field activities. This information can be organized in dedicated information layers, enriching the interpretation of the archaeological contexts with plural and

[11] https://ariadne-infrastructure.eu
[12] https://opencontext.org/
[13] https://www.tdar.org
[14] https://www.carpetaniaromanarustica.org/
[15] https://citizan.org.uk/

contextualized perspectives, and strengthening the link between cultural heritage and community. The development of a citizen-friendly app, based on mobile GIS technology, is one of the ultimate goals of the SHAReLAND project.

The ARGUS project and SHAReLAND can be complementary and mutually reinforcing initiatives, each contributing to a more comprehensive understanding and management of archaeological heritage. While ARGUS focuses primarily on the monitoring, and assessment of archaeological sites at risk, with particular attention to environmental threats, SHAReLAND, on the other hand, is dedicated to the mapping and analysis of archaeological evidence through a landscape archaeology approach, aiming to reconstruct and interpret the spatial and diachronic dynamics of human activity. Although ARGUS is centered on environmental datasets, it also accommodates the collection of diverse forms of cultural heritage documentation. This includes historical, artistic, and archival records, as well as technical and scientific data, all of which serve to characterize the cultural significance of the "Assets" and to support tailored protection and conservation strategies. The inclusion of such documentation would enhance the interpretive depth and specificity of the monitoring process, facilitating interventions that are sensitive to the unique features of each site.

The conceptual framework of ARGUS is underpinned by the PANOPTES ontology [6]. Among the key components of this ontology is the class ASSET and the related *"Cultural asset documentation"*, defined as a "document describing the Asset or related activities and events". A significant development currently in progress involves testing the integration of the ASSET entity (and the related *Cultural asset documentation* entity) with the SHAReLAND database. This effort aims to enrich the digital representation of cultural Assets by incorporating detailed archaeological data, interpretative models, and research outputs produced within the SHAReLAND framework. Through this interconnection, the ontology-based model of ARGUS is extended to encompass a broader range of data types, thereby bridging the gap between environmental monitoring and archaeological research.

Conversely, the integration of ARGUS's ontology into the SHAReLAND environment would enable users to visualize, query, and analyze environmental risk factors affecting the archaeological landscapes under study. This synergy would facilitate a holistic view of the sites, where environmental vulnerabilities and cultural values are considered jointly. Such an integrated approach not only enhances the diagnostic capabilities of researchers and heritage professionals but also supports informed decision-making for preservation policies and site management strategies. By promoting interoperability across multiple platforms - both through data integration and semantic linking – ARGUS contribute to the development of a more robust and adaptive infrastructure for cultural heritage protection – one that is grounded in both scientific analysis and contextual understanding.

VI Conclusions

Given the inherent complexities of archaeological data sharing, it is evident that controlled sharing environments—such as those established within European research consortia like ARGUS—offer a more manageable framework for balancing openness with protection. These settings provide a clear legal, technical, and ethical context for collaboration, reinforced by shared goals, funding conditions, and institutional agreements. Within such protected environments, it is possible to implement layered access systems, define roles and responsibilities, and develop interoperable data structures like those employed by the ARGUS project and the emerging SHAReLAND platform.

However, this relatively secure and structured model should not serve as a limitation or excuse to keep archaeological data siloed within project boundaries. On the contrary, the experience of initiatives such as ARGUS and SHAReLAND illustrates that it is possible—and increasingly necessary—to develop robust frameworks for broader data access and integration. These frameworks must address not only technical and regulatory requirements but also embed ethical principles that acknowledge the rights and responsibilities of all stakeholders, including researchers, local communities, heritage professionals, and the broader public.

What emerges clearly is the need for a hybrid model of data governance, where access is tailored according to user type, purpose, and sensitivity of the information. This involves differentiated access credentials, spatial generalization of sensitive locations, and metadata structures that preserve authorship, traceability, and transparency. Furthermore, the inclusion of local knowledge—valued both as a source of data and as a valuable element in interpretation—can no longer be seen as peripheral. It must be placed at the core of any ethical approach to archaeological data management.

The synergy between ARGUS and SHAReLAND points toward a future in which environmental risk modelling, archaeological landscape interpretation, and participatory knowledge creation are integrated within shared digital environments. The development and alignment of ontologies, like PANOPTES, and geospatial platforms, like GeoServer-based SHAReLAND, offer a practical path toward interoperability, enriching both the scientific and societal value of heritage data.

Responsible openness is not about indiscriminate data release, but about building transparent, inclusive, and flexible systems that foster collaboration while respecting cultural, ethical, and legal contexts. European heritage research can reshape not just data sharing, but also the co-creation of knowledge based on trust, mutual recognition, and long-term care.

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REFERENCES

[1] European Commission, Open Science. Policy priorities of the European Commission, Brussels, 2023. [Online]. Available: https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science_en

[2] ARIADNEplus Consortium, "ARIADNEplus: Advanced Research Infrastructure for Archaeological Dataset Networking in Europe," Horizon 2020 project 823914, 2019–2023. [Online]. Available: https://ariadne-infrastructure.eu

[3] PARTHENOS Consortium, "PARTHENOS: Pooling Activities, Resources and Tools for Heritage E-research Networking, Optimization and Synergies," Horizon 2020 project 654119, 2015–2019. [Online]. Available: https://www.parthenos-project.eu

[4] E-RIHS, "European Research Infrastructure for Heritage Science," ESFRI Roadmap Initiative. [Online]. Available: https://e-rihs.eu

[5] J. D. Richards and C. Hardman, "Stepping back from the trench edge: an archaeological perspective on the development of standards for recording and publication," in *The Virtual Representation of the Past*, M. Greengrass and L. Hughes, Eds. Farnham, Surrey and Burlington, USA: Ashgate Publishing Company, 2008, pp. 101–112.

[6] G. Pavlidis, V. Sevetlidis, and V. Arampatzakis, "PANOPTES: A Digital Twin Ontology for Cultural Asset Management," to appear in *Proc. of the IEEE Conference on Cultural Heritage (IEEE CH)*, 2025.

[7] L. Kong, A. Sarris, and Z. Boukhers, "A Framework for Cultural Heritage Data Historicity and Migration: The ARGUS Approach," to appear in *Proc. of the IEEE Conference on Cultural Heritage (IEEE CH)*, 2025.

[8] European Union, "Directive 2014/60/EU of the European Parliament and of the Council of 15 May 2014 on the return of cultural objects unlawfully removed from the territory of a Member State," *Official Journal of the European Union*, L 159, 28 May 2014.

[9] European Union, "Council Regulation (EC) No. 116/2009 of 18 December 2008 on the export of cultural goods," Official Journal of the European Union, L 39, 10 Feb. 2009

[10] European Union, "Regulation (EU) 2019/880 of the European Parliament and of the Council of 17 April 2019 on the introduction and the import of cultural goods," *Official Journal of the European Union*, L 151, 7 Jun. 2019.

[11] European Union, "Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information," *Official Journal of the European Union*, L 172, 26 Jun. 2019.

[12] European Union, "Directive (EU) 2019/790 of the European Parliament and of the Council of 17 April 2019 on copyright and related rights in the Digital Single Market," *Official Journal of the European Unio*n, L 130, 17 May 2019.

[13] European Commission, "Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information," Official Journal of the European Union, L 134, 31 May 2018. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018H0790

[14] European Union, "Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)," *Official Journal of the European Union*, L 108, 25 Apr. 2007.

[15] European Union, "Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 (General Data Protection Regulation)," *Official Journal of the European Union*, L 119, 4 May 2016.

[16] M. Jakobsson, et al., "Digital archiving in archaeology: The state of the art," *Internet Archaeol*., no. 58, 2021. [Online]. Available: https://intarch.ac.uk/journal/issue58/

[17] European Commission, "Commission Recommendation (EU) 2021/1970 of 10 November 2021 on a common European data space for cultural heritage," *Official Journal of the European Union*, L 402, 16 Nov. 2021.

[18] European Commission, "A European Collaborative Cloud for Cultural Heritage," Brussels, 2022. [Online]. Available: https://research-and-innovation.ec.europa.eu/research-area/social-sciences-and-humanities/cultural-heritage-and-cultural-and-creative-industries-ccis/cultural-heritage-cloud_en

[19] European Commission, European Framework for Action on Cultural Heritage, Brussels, Dec. 2018.

[20] Council of the European Union, "Council Conclusions on the need to bring cultural heritage to the fore across EU policies," 9015/18 CULT 70, Brussels, 8 Jun. 2018.

[21] Council of the European Union, "Council Conclusions on risk management in the area of cultural heritage," Brussels, 26 May 2020.

[22] Council of Europe, Revised European Convention on the Protection of the Archaeological Heritage (Valletta Convention), 1992.

[23] Council of Europe, Convention for the Protection of the Architectural Heritage of Europe (Granada Convention), Granada, 3 Oct. 1985. [Online]. Available: https://www.coe.int/en/web/culture-and-heritage/granada-convention

[24] Council of Europe, European Landscape Convention, Florence, 20 October 2000. [Online]. Available: https://www.coe.int/en/web/landscape

[25] Council of Europe, Framework Convention on the Value of Cultural Heritage for Society (Faro Convention), 2005.

[26] J. Huggett, "Promise and paradox: Accessing open data in archaeology," in Proc. Digital Humanities Congress 2012, C. Mills, M. Pidd, and E. Ward, Eds. Sheffield: The Digital Humanities Institute, 2014. [Online]. Available: https://www.dhi.ac.uk/openbook/chapter/dhc2012-huggett

[27] L. J. Richardson, "Ethical challenges in digital public archaeology," *Journal of Computer Applications in Archaeology*, vol. 1, pp. 64–73, 2018. [Online]. Available: https://doi.org/10.5334/jcaa.13

[28] L. M. Dennis, "Digital archaeological ethics: Successes and failures in disciplinary attention," *Journal of Computer Applications in Archaeology*, vol. 3, no. 1, pp. 210–218, 2020. [Online]. Available: https://doi.org/10.5334/jcaa.24

[29] M. Bottoni, E. Bellini, and E. Farinetti, "Towards a reputational-based trustworthy archaeological information system," in *Proc. 2024 IEEE Int. Conf. on Cyber Security and Resilience (CSR)*, Athens, Greece, Jul. 2024. [Online]. Available: https://doi.org/10.1109/CSR61664.2024.10679376

[30] E. Farinetti and F. Chelazzi, "Open archaeological landscapes: Towards an educational approach to data sharing and reuse," in *Proceedings of the CAA 2021: Digital Crossroads*, in press.

[31] S. Costa, A. Beck, A. Bevan, and J. Ogden, "Defining and advocating open data in archaeology," in *Archaeology in the Digital Era: Papers from the 40th Annual Conference of Computer Applications and Quantitative Methods in Archaeology (CAA), Southampton, 26–29 March 2012*, G. Earl, T. Sly, A. Chrysanthi, P. Murrieta-Flores, C. Papadopoulos, I. Romanowska, and D. Wheatley, Eds. Amsterdam: Amsterdam University Press, 2016, pp. 449–456.

[32] S. Belotti, F. Burini, and A. Ghisalberti, "L'Università tra ricerca e co-progettazione: l'applicazione del modello a Tripla Elica allargata ai Gruppi di Azione Locale," *Geography Notebooks*, vol. 7, no. 2, pp. 43–63, 2024. [Online]. Available: https://doi.org/10.7358/gn-2024-002-belo