Research Article

Lisa Börjesson*

Legacy in the Making – A Knowledge Infrastructural Perspective on Systems for Archeological Information Sharing

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Abstract: Archeological research depends on a complex infrastructure of information systems and services built on different funding models. The information systems enable innovative approaches and progress in information making, but each system also organizes information by means of the system design, the structures, and relations established and the terminologies promoted. This article adopts a knowledge infrastructural perspective on systems used for information sharing in archeology. The purpose is first to expand the perspective on the systems for research information sharing in archeology and second to discuss the potential impact of the knowledge infrastructure on disciplinary knowledge-making, the shaping of archeological information, and legacy data. Based on an analysis of qualitative interviews (N = 31) with archeologists from Europe and the United States, the results show that the interviewees use sharing solutions developed within the archeology discipline as well as general information sharing systems. One important task for further research is to better understand how archeologists choose information sharing systems and how their choices impact what information they share. Also, information sharing for specific topics or with specific coverage appears to be developed with project funding outside of the more established sharing institutions. A key question for the infrastructural sustainability is how to support the inclusion of innovative sharing solutions in institutionalized sharing environments. The results emphasize the need for further studies of how information systems shape archeological legacy in the making, which in turn will support data literacy awareness and training.

Keywords: archeological data, research data management, information systems, information sharing, knowledge infrastructures, archeological management

1 Introduction

Research depends on complex knowledge infrastructures made of a variety of components such as instruments, data standards, information systems, digital archives, metadata, and discovery services (Borgman, Darch, Sands, & Golshan, 2016). Infrastructural components are intertwined in sociotechnical regimes shaping and shaped by research inquiry, activities and social formations, regulations, and investments in equipment and competencies (Geels & Schot, 2007; Smiraglia, 2014). Components can be more or less

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*** Corresponding author: Lisa Börjesson,** Department of ALM, Uppsala University, Box 625, SE-751 26 Uppsala, Sweden, e-mail: Lisa.borjesson@abm.uu.se

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fragile in the sense that they build on more or less dependable models for continuous funding, maintenance, and development (Borgman et al., 2016). The research–system integration makes up grounds for a growing market sector building on a variety of economic principles from for-profit to volunteer work. However, all systems share the basic premises: a system needs to serve research needs and whatever organization funding the system needs to somehow cover system-related costs.

Archeologists rely on numerous knowledge infrastructural components on a daily basis to collect, organize, and analyze their data and to communicate their findings. Such examples are map archives for locating sites, Geographical Information Systems (GIS) for capturing landscape features, and 3D scanning to document building structures. Archeologists share this system dependency with other researchers as well as with other professions. In some fields, for example, in biomedical laboratory research, the work environment is permeated by a mesh of more or less integrated systems directing workflows, running equipment, collecting data, and providing input to clinical treatments (Petrides et al., 2017). Each of the systems used to carry out different work tasks simultaneously shape and re-shape the information managed within the systems by means of knowledge-organization, information formats, and forms of presentation (Smiraglia, 2014).

Previous research paying attention to systems used in archeology has reflected on how methods and systems used in fieldwork shape documentation, archeological knowledge making, and archeological legacy data (Allison, 2008; Huvila, 2006; Lucas, 2012). As methods and outputs have become increasingly digital, the focus has turned toward the most pressing information-related issues in the digital realm. While the research on methods development discusses the knowledge-making potentials and implications of novel documentation technologies (Dell'Unto, Landeschi, Apel, & Poggi, 2017), significant attention is also directed toward the preservation and the future access of digital outputs. One research strand examines the governance of archeological data, i.e., the laws and policies regulating data and data access on an infrastructural scale (Aloia et al., 2017; Gupta, Blair, & Nicholas, 2020). A closely related strand focuses on data stewardship, a long-term perspective on data management, and data-level issues of access, e.g., potential implications of system dependency (Bibby, 2017; Wright & Richards, 2018). Parallel to the efforts to make data accessible and interoperable, recent work emphasizes the need to develop disciplinary data literacies, i.e., to develop insights into data workflows and systems within and across disciplinary boundaries to make the most of the data now available (Kansa & Kansa, 2021).

Informed by the perspective that past research outputs are a legacy that needs to be read and analyzed in context (Allison, 2008) and by the need to develop the grounds for archeological data literacy (Kansa & Kansa, 2021), this article asks what systems are used for contemporary archeological information sharing. Sharing by activities such as publishing or depositing code, data, models, reports, and articles in repositories is here seen as a work task where the information creation continues with and by the sharing activity (Gorichanaz, 2019; Pilerot, 2012). For example, a fieldwork dataset continues to be created as it is described with mandatory or optional metadata fields in a repository even if the description takes place months or years after the fieldwork was finalized. This continuous perspective on information sharing highlights the potential impact of the sharing system for the shaping of legacy data and information transfer to a future user.

The purpose of this study is twofold as it first aims to expand the perspective on the information systems that archeologists make use of by mapping both the sharing systems particular to archeology and information systems with a more general application but that are crucial to archeological work. The mapping is guided by four research questions answered based on a combination of qualitative interview data ($N = 31$) and data harvested from information system owners:

- RQ1. Which information systems do archeologists use to share their output?
- RQ2. Who owns and develops the systems used for information sharing work tasks?
- RQ3. How is system maintenance and development financed?
- RQ4. Which are the terms of use for each of the sharing systems? E.g., who pays for usage and how is the payment transferred?

An infrastructural perspective on the institutional backing and funding models behind each system aid in analyzing the characteristics and sustainability of the knowledge infrastructure from a disciplinary archeological perspective.

The second aim is to, based on the systems mapping, engage the infrastructural perspective with that of disciplinary knowledge making and reflect on the potential implications of archeologists' choice of sharing systems on the shaping of archeological information and legacy data. The second aim is fulfilled by a discussion drawing on examples from the interview data and previous research, resulting in the identification of new questions about the emerging landscape for archeological information sharing that require further research attention.

This study shows that while several systems for information sharing are owned and maintained by different academic and archeological collectives and consortia, there are also commercial solutions offering services that archeologists find as the most purposeful for their sharing activities. The results also indicate that discipline-specific sharing solutions contextualizing shared resources with archeological metadata exist parallel with the general sharing solutions making data deposit with less specialized metadata possible. The results point to a number of new research questions on infrastructural sustainability, from both a resource findability and a resource persistence perspective. An illustrative example is how data can be highly contextualized in a specialized database and therefore apt for re-use, but at the same time fragile if the specialized database builds on one or few individuals' research grants. The reverse situation can be found where single datasets are deposited with little description in general data repositories where it is likely to persist and thereby serve the storage purpose for the individual researcher creating the dataset, but where it is less likely to be found and connected with other relevant data sets. The results also point to the need for further inquiry into the implications of funding models on archeological knowledge-making from short-, mid-, and long-term perspectives. On an even more over-arching level, the complexity and the number of different systems uncovered by the analysis motivates a discussion of the role of systems development for archeological knowledge-making and thereby raises the question of if and how far information sharing systems design and content can and should be standardized.

The following section describes the methods and material used. Thereafter, the results of each of the research questions are accounted for. The final part summarizes an overall picture of the information systems landscape and the funding models on which it relies in the selected sample of archeology. The discussion also brings up the potential implications for archeological knowledge making and directions for future research combining perspectives from science and information studies to analyze the implications of information systems on archeological information creation and knowledge-making. The discussion also includes a reflection on the results in relation to the archeological subdisciplines represented in this particular survey, identifies potential biases in the material, and evaluates the survey method.

2 Methods and Material

The qualitative mapping of information systems is based on thirty-one qualitative interviews (id. A-AE) on research data production and re-use conducted February 2020 to July 2021. A purposive, theoretical sampling strategy (Robinson, 2014) aiming at recruiting interviewees from as many archeological sub-disciplines as possible resulted in a data set including archeologists based in the Nordic countries ($N = 12$, 39%), continental Europe ($N = 7$, 22%), the United States ($N = 7$, 22%), and the United Kingdom and Ireland ($N = 5$, 16%). The following thematic representations of the interviewees' one main research interest and one main methodological specialization are based on self-reported interests and specializations in web page presentations, e.g., in bios on universities' personal web pages.

The thematic summaries in Tables 1 and 2 provide an overview of the variety of research profiles represented in the sample. Methodological specialties such as statistical analyses in various software environments, VR, 3D modeling, and archeological science are included. The sample also includes archeologists with data-related methods as methodological specialization, i.e., database construction or integration, and those with less or no specific interest in research data management. The spread of levels of interests in research data management makes it more likely that both well-established systems and systems under development are covered in the analysis.

Table 1: Research interests represented in the sample, thematic overview

Research interests represented in the sample	
Geographical area or time period in focus	– Ancient near eastern empires; historical archeology; Medieval archeology; Mediterranean archeology
Area/phenomena in focus of inquiry	– Environmental archeology; landscape archeology; maritime archeology; zooarcheology – Ancient spaces; architecture; historical buildings – Fire-based activities – Hominin colonization; settlement patterns
Material in focus	– Ceramics; lithic materials; material culture
Methodological focus	– Digital imaging; GIS; heritage management; spatial archeometry; tephrochronology; integrative paleoscience

Table 2: Methodological specializations represented in the sample, thematic overview

Methodological specializations represented in the sample	
Archeological methods	– 3D spatial analysis; archeological field survey; big data analyses; ceramics analyses; contract archeology; demographic analyses; evolutionary ecology analyses; experimental archeology; GIS; sensory archeology; spatial network analysis; visual and spectral analyses; visual documentation
Data related methods	– Database construction; database integration; database management; data publishing; digital preservation; spatial information management

The sample of interviewees is considerably smaller than the sample of respondents in survey studies covering similar questions. While the most recent ARIADNEplus survey covering 484 respondents provides a more comprehensive insight into barriers to data publication and data reuse as an imperative for infrastructural development (Geser, 2019), the present interview study complements with a practice-oriented description of the systems underpinning archeological work today, shaping documentary legacy.

The interviews focused on concrete examples of making and re-use of archeological data. The systems mentioned in the interviews are such that the archeologists use to conduct their daily work. As the interview data reflect what the interviewees express, it will not give an exhaustive but rather a selective representation of systems actually used. A broad definition of "information systems" is employed to encompass the entities that interviewees mention as supporting their information sharing activities such as communication, deposit, storage, archiving, and distribution (Swanson, 2018). The analog systems are excluded from the analysis as the purpose of the analysis is to map the emerging digital systems landscape. To identify information system properties (ownership, financing, and terms of use), descriptive information was harvested from the information systems' websites as accounted for in Appendix II.

The interviews were recorded by the interviewer in Zoom and transcribed in clean verbatim in the language used during the interview (English, Swedish, or Norwegian) by a professional transcription company. All mentions of systems are coded in NVivo 12 for traceability.

3 Results

All systems for information sharing mentioned in the interview data are listed in Appendix I. As evident, the systems mentioned do not equal what would be found in an exhaustive survey of all existing systems. Also, the systems mentioned range from established repositories to small-scale database projects. For example, some interviewees talk about their use of a general national data repository, while others focus on a specific database that they themselves contribute to. This spread is the result of the interview data approach for this

initial mapping. The upside is that the material gives a rich picture of information systems used to conduct archeological work from original research to information re-use, which future studies will report further on. The following presentation is divided into four subsets: archeology-specific but topic-general sharing systems, archeology and multidisciplinary project- and network-based sharing systems based on a certain research interest or similar, nondisciplinary-specific national sharing systems, and nondisciplinary-specific general sharing systems.

3.1 Archeology Discipline-Specific, Topic-General Sharing Systems

The interviewees use a number of archeology discipline-specific but topic-general sharing systems. Among these are systems for finds and sites registry managed by national government bodies like the Norweigan heritage database Askeladden and the collections database MUSIT, the Swedish national heritage registry KMR (formerly FMIS), and Ísleif, the Icelandic database combining archeological site data with historical and ethnographic site data. These databases are funded by pre-existing institutions and serve to carry out heritage management on a state level. The immediate access to the complete databases varies and also depends on (human or machine supported) language skills of the user.

Another set of sharing systems are those developed specifically for data sharing, backed by organizations developed to fund, develop, and maintain the sharing system. Among these, we find the UK-based ADS and the US-based tDAR, both hosted at university institutions. OpenContext serves a similar infrastructural function for data sharing but is hosted by a nonprofit organization.

The UK Portable Antiquities Scheme and the Dutch Portable Antiquities of the Netherlands are examples of data sharing solutions specifically for objects found by the public and in private collections that cover the same types of finds in different national contexts but that build on different funding solutions. While the UK scheme is hosted by a national museum, the Dutch version is primarily funded by the Dutch organization for Scientific Research (NWO).

3.2 Archeology and Multidisciplinary Project- and Network-Based Sharing Systems

Parallel to the discipline-specific but topic-general sharing systems, a number of archeology and multidisciplinary project and research network-based sharing systems are mentioned in the interviews. There are overlaps between the data created and aggregated in the projects and networks mentioned here with the resources that are deposited in the general sharing systems. For example, data in the Jarðabókin project database do also appear to a limited extent in the Ísleif database. However, there are also instances where, for example, a project-based sharing system is the exclusive point of access to a certain dataset, like in the case of the Roman Hinterland Database Project, and therefore make up a unique infrastructural component.

The feature characterizing project- and network-based sharing solutions is that they bring together information resources that would not be joined in topic-general sharing systems, and at a level of topical granularity that would not be represented as clearly in the general sharing systems. For example, the dataARC project covers a specific geographical area, and the SEAD database includes data relevant to environmental research from different disciplinary origins.

The scale of the project and network-based sharing systems differ and the financing of these databases varies accordingly. Comprehensive efforts like the Past Global Changes (Pages) effort to coordinate and promote databases, and metadata-databases are backed by a nonprofit organization funded by several national academies of sciences, while databases of lesser but still significant scope like the Roman Hinterland Project database rely on research funding and yet others depend on volunteer work, like BugsCEP.

3.3 Nondisciplinary-Specific National Sharing Systems

Nondisciplinary-specific national sharing systems are mentioned for sharing of both data and publications. The Dutch DANS and the Swedish SND are two systems for data sharing that make data from several disciplines available. Both solutions are hosted by institutions that receive national research infrastructure funding and that combine the repository service with other research data sharing support functions like policy development and user training. While the sharing solutions might seem interchangeable, they differ with respect to whether they offer long-term data archiving or make up but a catalog of data archived at university institutions.

3.4 Nondisciplinary-Specific General Sharing Systems

In addition to the archeology and nondisciplinary-specific but national sharing systems mentioned earlier, the interview data reveal the usage of a range of different nondisciplinary-specific general sharing solutions used not only for sharing code and software but also for data sharing and sharing of presentations, papers, and video recordings from fieldwork. While these systems vary from being commercial solutions like GitHub, Figshare, and YouTube, other systems like Arxiv, Zenodo, and Dataverse are in different ways hosted by university institutions and funded by research infrastructures or research grants. The Open Science Foundation's funding is a hybrid solution of public and commercial funding. Common to all these solutions is that use is free of charge at the entry level.

4 Discussion

To summarize, the information sharing solutions mentioned by the interviewees can be divided into four main categories based on their scope and relation to the archeology discipline. The analysis distinguishes between sharing systems developed internally in the archeology discipline and externally to the discipline, between systems that are general and those that are project- or research topic-specific, and between systems that are developed by national bodies or by organizations dedicated to providing sharing solutions. It should be noted that individual interviewees use a combination of systems to fulfill their information-sharing needs. This analysis does not reflect individuals' combined choice of systems but rather map system usage on a group level.

The knowledge infrastructural perspective on the sharing systems usage influenced by Borgman, Scharnhorst, and Golshan (2019) make clear that some of the systems used are closer related to the discipline and more directly influenced by disciplinary data governance efforts in the form of guidelines and best practice guides as implemented, for example, in data ingestion processes. The knowledge infrastructural perspective also highlights the potential vulnerable parts of the archeological knowledge infrastructure. Infrastructural vulnerabilities are further detailed and accompanied by suggestions for solutions by the ARIADNEplus team (Geser, 2019). However, it is important to note that while ARIADNEplus aims at evaluating infrastructural weaknesses and propose solutions, the goal of the current study is to provide insight into current disciplinary practice with the purpose of contextualizing documentation and data creation in the making.

A recurring suggestion in the ARIADNEplus report (e.g. p. 12), reflected also by Kansa and Kansa's call for archeological data literacy training (2021), is that a heightened awareness of Open Science policies and principles for FAIR data sharing will strengthen the archeological knowledge infrastructures. Awareness and training are decidedly core strategies to improve data reusability in the future. However, disciplinary data literacy education should be informed not only by the ideal state of affairs as outlined by Open Science initiatives but also by the realities of where and how to find and read digital data from the naissance of

digital technologies and up until today. Therefore, the discipline also needs historical accounts of information systems usage. The number and variety of information sharing solutions uncovered by this mapping indicate a great complexity of the information sharing infrastructure in archeology. Thus, both descriptive and analytical studies of the systems used, the particular sharing purposes they serve, the rationales for choosing one system over another (e.g., choosing a general system like Zenodo instead of a discipline specific like tDAR), and the ways they organize information and knowledge-making by assuming certain categories, using terms and establishing relations is crucial in understanding and assessing resources created and shared using a certain system (Smiraglia, 2014).

Besides underlining the need to describe the number and variety of systems for information sharing, the complexity of the archeological knowledge infrastructure demonstrated by the analysis raises a pertinent question about the function of systems in the discipline: Do systems for information sharing merely make up infrastructure in the sense of pipes carrying information content, or are the systems developed for topic- or project-specific information sharing also vehicles for conceptual and methodological advancement? Assuming the former perspective of systems as scaffolding for information transfer is to a higher degree compatible with both system and content standardization and institutionalization. Assuming the latter perspective of systems development as integral to knowledge-making implies that the system is subject to a life cycle with an inherent rise and fall in usage intensity depending on its functionality for research, i.e., the system's ability to fulfill users' knowledge-making needs (compared with Bölen, Calisir, & Özen, 2021). If assuming the latter perspective on systems development as integral to research, then follows the challenge of how to support individuals' and research collectives' innovative development and use of information sharing systems as part of projects and networks and at the same time mitigate the risks of information loss and loss of access in a long-term perspective. This question, about how the purpose of sharing systems is viewed and understood in the discipline, has direct implications for how infrastructural development is designed.

Certain limitations should be taken into account when evaluating the results of this study. The sample represents geographical areas where archeology presumably is relatively well funded, enabling, for example, data deposit fees to be paid. The results would possibly shift in favor of no-fee systems if archeologists from less-affluent geographical areas were included. Furthermore, a cross-analysis of subdisciplinary affiliation and methodological specialization and information system use would give further insight into particular areas of the archeological information infrastructure, e.g.: Are important data sharing advancements made using systems developed outside of the discipline? How are long-term archeological research interests accounted for in novel, general sharing solutions where the impact of the institutions influencing archeological data governance may be weaker? Furthermore, the definition of information systems is inclusive to capture as much of the research information infrastructural landscape as possible. A more limited definition of systems, for example a focus on systems used for code sharing, would drill deeper into the characteristics of specific parts of the infrastructure.

In sum, even though the interviews represent a subset of archeology and the results could be refined with more detailed analyses of variables in the interview data and with extensions of the dataset, the current study serves as an initial mapping of the information systems making up the knowledge infrastructure in archeology and raises questions for further research attention. On the most fundamental level, a mapping of archaeological information sharing systems' life cycles and the sociotechnical transition pathways between different sharing solutions would give a picture of system succession in the discipline over time (Bölen et al., 2021; Geels & Schot, 2007). Such a perspective would complement previous works tracing the theoretical and methodological history of archeological documentation (e.g. Lucas, 2012), and spur and reinvigorate the interest in examining the theoretical assumptions embedded in the systems used to carry out archeological information work. A renewed engagement with the information systems perspective would bridge previous critical perspectives on analog documentation with parallel insights into the theoretical interests and assumptions underpinning digital archeological information making and sharing.

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Appendices

Appendix I. Properties of Systems Used for Information Sharing

Properties of systems used for information sharing				
Information system	Description	Ownership	Financing	Terms of Use
Archeology data service (1)	Digital repository in the UK for heritage data	Hosted by the University of York	Mainly project funded	Pay to deposit, free to access
Arxiv (2)	Distribution service and open-access archive	Hosted by Cornell University	Simons Foundation and membership institutions	Free to access
Askeladden (3)	Norwegian database for cultural heritage	Museum of Cultural History, University of Oslo	Museum of Cultural History, University of Oslo	Database access restricted to professionals and students (resources possible to search through open database interface and ArcGIS interface)
BugsCEP (4)	Database, a research and teaching aid	Private	Research funding, volunteer work	Free to access, citations
DANS (5)	Dutch national centre of expertise and repository for research data	KNAW (Royal Netherlands Academy of Arts and Sciences) and NWO (Dutch Research Council)	KNAW (Royal Netherlands Academy of Arts and Sciences) and NWO (Dutch Research Council)	Pay to deposit, free to access
DARE repository (6)	Joint initiative of Dutch universities to make their academic output digitally accessible	Dutch universities	Dutch universities and university libraries	Free to access
dataARC (7)	Infrastructure to support transdisciplinary research on human-environment interactions in the North Atlantic	National Science Foundation Projects: cyberNABO 1.0 and cyberNABO 2.0	The National Science Foundation	Free to access
Dataverse (8)	Open source research data repository software, local installations	Harvard's Institute for Quantitative Social Science (IQSS)	Funded by Harvard with additional support from the Alfred P. Sloan Foundation, National Science	Free to access

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			Foundation, National Institutes of Health, Helmsley Charitable Trust, IQSS's Henry A. Murray Research Archive	
Figshare (9)	Repository where users can make research outputs available, citable, shareable, and discoverable	Digital Science	Commercial	Free to access
KMR, Kulturmiljöregistret (10)	National heritage registry	The Swedish National Heritage Board	The Swedish National Heritage Board	Free to access
GitHub (11)	Software development platform	Microsoft	Platform user plans	Free to access
Ísleif, the Icelandic archeological database (12)	Access database combining archeological site data with historical and ethnographic data	The Institute of Archaeology, Iceland	Supported by The Institute of Archaeology, Iceland	Access through owning institution
Jarðabókin (13)	To make available documents describing land use in late medieval to early modern Iceland	Created by researcher employed at public Swedish university, published with CC BY license	Supported by Fornleifastofnun Íslands, Umea University, Humlab, DataArc and The North Atlantic Biocultural Organization	Originally free to access, in September 2021 content available only as a GitHub repository
MUSIT-databases (14)	Collection databases from Norwegian university museums	State/Norwegian university museums	Museum funding; Research funding	Free to access
OpenContext (15)	Web-based research data publishing	The Alexandria Institute (nonprofit organization)	Foundation grants and charitable donations	Pay to deposit, free to access
Open Science Foundation (16)	Software for project management, documentation, data storage and sharing	Center for Open Science (nonprofit technology organization)	Grants from federal agencies, private foundations, and commercial entities	Free to use
PAGES (17)	International effort to coordinate and promote past global change metadatabases and databases	Future Earth (nonprofit organization)	the Swiss Academy of Sciences and Chinese Academy of Sciences, and supported in-kind by the University of Bern, Switzerland	Free to access

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Portable Antiquities Scheme (18)	Database for the recording of archeological objects found by members of the public in England and Wales	The British Museum and Amgueddfa Cymru – National Museum Wales	Museum funding	Free to access
Portable Antiquities Netherlands (19)	Database to document and publish finds of archeological interest, mainly those of metal, found by members of the general public and in private collections	Coordinated by the Vrije Universiteit Amsterdam (VU)	Dutch organisation for Scientific Research (NWO) and additionally by the National Heritage Agency (RCE) and the Vrije Universiteit Amsterdam (VU)	Free to access
The Roman Hinterland Project Database (20)	Database to combine intensive survey data collected over the past 70 years in the territory of Rome to create the largest integrated regional dataset for the hinterland of any ancient Mediterranean city	A consortium of researchers	Research project funding	Access within consortium
The Strategic Environmental Archaeology Database (SEAD) (21)	National research infrastructure for archaeology and an international standard database for environmental archeology data	Environmental Archaeology Lab (MAL), in collaboration with HUMlab at Umeå University, Sweden	Research and research infrastructure funding	Free to access
SND (22)	Swedish National Catalogue for Research Data	A consortium of universities	University funding	Free to access
tDAR (23)	International digital repository for the digital records of archeological investigations	Digital Antiquity, a multi-institutional organization that has been explicitly designed to ensure the long-term financial, technical, and social sustainability of tDAR	Arizona State University, the Andrew W. Mellon Foundation, and the National Science Foundation, and a grant jointly funded by the National Endowment for the Humanities and the	Pay to deposit, free to access

(*Continued*)

Appendix I (*Continued*)

			Higher Education Funding Council for England of the United Kingdom acting through the Joint Information Systems Committee (JISC)	
YouTube (24)	Web page for sharing video content	Google	Advertising	Free to deposit, free to access
Zenodo (25)	Repository for sharing, curation and publication of data and software	CERN (intergovernmental organization)	European Commission, CERN, Alfred P. Sloan Foundation, Arcadia Fund, and donations	Free to deposit, free to access

Appendix II. Information System Property Information Sources

The information system property information is harvested from the following web pages including subpages June 30, 2021:

(1) https://archaeologydataservice.ac.uk/; https://archaeologydataservice.ac.uk/about/finance.xhtml
(2) https://arxiv.org/; https://arxiv.org/about/ourmembers
(3) https://askeladden.ra.no/
(4) http://www.bugscep.com/
(5) https://dans.knaw.nl/en
(6) E.g. https://dare.uva.nl/
(7) https://www.data-arc.org/about/the-project/
(8) https://dataverse.org/about
(9) https://figshare.com/about
(10) https://app.raa.se/open/fornsok/
(11) https://github.com/about
(12) https://fornleif.is/eng/
(13) Originally: http://jardabok.com/. In September 2021, content available at: https://github.com/castuofa/dataarc-source/tree/main/datasets/icelandic_farms
(14) Multiple databases accessible at https://www.unimus.no/
(15) https://opencontext.org/
(16) https://www.cos.io/products/osf
(17) http://pastglobalchanges.org/
(18) https://finds.org.uk/
(19) https://portable-antiquities.nl/pan/#/public
(20) https://comparativesurveyarchaeology.org/
(21) https://www.sead.se/
(22) https://snd.gu.se/en
(23) https://core.tdar.org/
(24) https://www.youtube.com/
(25) https://zenodo.org/