Digging Data

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Chapter 1 Introduction

1.1 Introduction

In 1992 the European Convention for the Protection of the Archaeological Heritage took place in Valletta, Malta. This Convention was initiated by the movement to minimise the loss of archaeological information. It has had a significant impact on archaeological practice in the Netherlands and many other European countries. The Convention states that "The aim of this (revised) Convention is to protect the archaeological heritage as a source of the European collective memory and as an instrument for historical and scientific study." (Council of Europe 1992a). The Convention was held because of severe difficulties in archaeological research. Due to many construction projects in the previous years, a lot of archaeological remains were being destroyed without diligent excavation. Even when archaeological research was undertaken, it was done hurriedly and lacked proper documentation and publication. Realizing that archaeological remains are a finite source, awareness arose that the information collected at sites that were subsequently destroyed, can never be retrieved. To ensure archaeological information would never be as easily destroyed as it was before, a plan was formulated to embed archaeology within spatial planning.

This thesis will review whether this has been accomplished by focussing on article 7 of the Convention. What has article 7 of the Malta convention accomplished in the reuse of archaeological data in scientific research in the Netherlands? Article 7 is stated as following (Council of Europe 1992a):

Collection and dissemination of scientific information

Article 7

For the purpose of facilitating the study of, and dissemination of knowledge about, archaeological discoveries, each Party undertakes:

i. *to make or bring up to date surveys, inventories and maps of archaeological sites in the areas within its jurisdiction;*

ii. *to take all practical measures to ensure the drafting, following archaeological operations, of a publishable scientific summary record before the necessary comprehensive publication of specialised studies*.

It will review to what effect this has been done and what this means for archaeology in the Netherlands. For it is imperative that when archaeological research is performed, it is documented correctly. However, when all is documented, it is usually treated as something that should be kept for some ambiguous future purpose. Only to be stored away in such a way that it becomes inaccessible and unworkable. This stems from a deep-rooted preconception about archaeological discoveries, that are described as the following by Nick Merriman and Hedley Swain (1999):

> **"*Archaeology continues, both in the mind of the public and that of the discipline itself, to place greater value on romantic-heroic notions of discovery of new data through fieldwork than on the analysis of material that has already been excavated.*" (262).**

While this statement is 20 years old, this disposition still holds true today and needs to be addressed, for why should archaeological excavations be meticulously documented if this documentation is not used to gain new archaeological knowledge? When treated this way, the documentation is only a fact-producing system, and no new insights will be obtained (Kristiansen 2009, 644). A lot more can be gained from studying reports and finds from excavations. New archaeological insights derive from publications and symposia. It can however also be obtained by studying data from archaeological research; by reviewing data with a fresh perspective.

Research data comes in many shapes and sizes, and stems from different kinds of research, such as excavations, surveys, experiments, interviews, artefact studies and other methods. As such, it is important to define what data exactly is. In this study the definition of Christine Borgman will be used (Professor in Information Studies at UCLA), as data refers to "*entities used as evidence of phenomena for the purpose of research or scholarship*" (Borgman 2015, 29).

This study contemplates the notion that even though article 7 of the Malta Convention has been implemented in the Netherlands, too little is achieved with the information that has been collected through archaeological research. The Convention states that it is important that comprehensive publication takes place, yet only requires a summary scientific record. It is the question of is everything being done to ensure that these first summaries become part of a specialist study and are being published?

This will be researched by focussing on the storage of archaeological data at DANS (Data Archiving Networked Services) and on reuse of this data.

To answer the overall question several aspects will be considered, which are divided in different chapters. The questions that need to be answered are:

- How did the Malta Convention, and especially article 7, take shape within the Netherlands?
- What does the DANS repository add to Dutch archaeology data storage?
- To what extent is the archaeological data stored at DANS being reused?
- How is article 7 implemented in other European countries, and what can be learned from them?
- Is the archaeological data made accessible in an international perspective and why is this important?

To obtain the answers to the research questions, different methods will be used in combination. It will be done by conducting a literature study, gathering data at DANS and interviewing experts in the field of digital repositories. This will be further discussed in the following paragraph methods.

1.2 Malta in the Netherlands

Starting this research, a comprehensive background study was done which included as many publications as possible concerning the implementation of the Convention in the Netherlands. The research started with the optimistic conjecture of what Malta would change in the Dutch archaeological landscape, in literature from the 1990's. This included specifications of what the summary reports should encompass, or even discussing the possibility of full publications paid for by the construction company (Van Marrewijk and Brandt 1997, 70). For the dissemination of knowledge gained at excavations P.A.M. Zoetbrood (who was employed at the ROB, Rijksdienst Oudheidkundig Bodemonderzoek; National Archaeological Survey Service in 1997), predicted that a *Virtual Archaeological Archive of the Netherlands* would become the solution to the continuing documentation problem (Zoetbrood *et al.* 1997, 344).
In 2001 a positive recommendation by the Raad voor Cultuur (Board of Culture, which advises the minister of the Ministry of Education, Culture and Science) followed, for the implementation of Malta (Raad voor Cultuur 2001). In their advisory function, the Raad evaluated the need for implementation and concluded that by incorporating

archaeology in spatial planning, it would gain a greater social function throughout the nation.

With the legislating in 2007, there were also some pessimistic sentiments about its use for archaeology. For example, archaeologist Daan Raemakers (professor of North western Archaeology at the University of Groningen) highlights the discrepancy between the goal of the archaeologists – gaining new insights – and the goal of developers, spending as little as possible (Raemakers 2007, 18). With the "disturber pays" principle Raemakers also fears that there will not be sufficient funds available to properly document the excavation, which will create poor quality reports. This is rebutted by Riemer Knoop, who is board member of the SIKB (Stichting Infrastructuur Kwaliteitsborging Bodembeheer; Foundation for Infrastructure Quality Assurance of Soil Management), the institution that maintains the KNA (Kwaliteitsnorm Nederlandse Archeologie; Dutch Archaeology Quality Standard). He states that while there is a distinction in ambition between archaeologists and contractors, this will be surmounted by the fact that the conducting of archaeological research is mandated and reviewed by the state agency (Knoop 2008, 36-37). By following the law and the KNA, reports of scientific value will be generated. This is acknowledged by Jos Bazelmans (current Head of archaeology at the Rijksdienst voor het Cultureel Erfgoed; RCE; the Dutch Cultural Heritage Agency) in his evaluation of the implementation of Malta. He states that because of Malta the amount of archaeological research has grown exponentially, which is corroborated in the Erfgoedbalans 2009 (Bazelmans 2009, 8; Beukers 2009, 229). This amount of research and their accompanying archaeological reports have expanded to such a multitude that it has become impossible for any one person to keep up with. Be that as it may, it is also not necessary to keep up with *all* archaeological reports, for in this wealth of reports a researcher can select the few that are relevant for their specific investigation.

In 2011 an evaluation of the implementation of Malta principles was undertaken. The Board of Culture reacted to the Erfgoedbalans 2009 and noticed a positive development of the integration of archaeology within spatial planning (Raad voor Cultuur 2011). The Board believe that this measure includes archaeology in the local community. The board commends the Monument Law in its excavation practice and optimal conservation of information. They do however advise to put more emphasis on the reuse of information. Knowledge can only be produced by actively engaging with excavation data, stating that knowledge is produced while data is collected. Another evaluation was undertaken by the RCE. In this study Liesbeth Theunissen (archaeological resource manager at the RCE)

and Jos Deeben (former head of archaeology at the RCE) ask whether the 'Malta'-research has led to new archaeological knowledge (Theunissen and Deeben 2011, 17). For this research 2593 research reports from the year 2009 were studied, of which 5% led to actual excavation. These 129 excavation reports were reviewed. On whether any knowledge was gained from those excavations. Another reviewed area was described as synthesising works, containing dissertations, peer reviewed journal articles, or any Liber Amicorum publications from 2007-2010, that were based on archaeological excavation reports. From a thorough investigation Theunissen and Deeben conclude that results from Malta-research are certainly finding their way into synthesising publications (Theunissen and Deeben 2011, 33). Another evaluation was carried out by Monique van den Dries (associate professor of archaeological heritage management at Leiden University), in which she examined the Dutch heritage management model, and explains how she believes that commercial archaeology can be knowledge producing, and not just fact producing (Van den Dries 2011, 597). She expresses an important aspect that should not be overlooked; the step of reuse of information, she conjectures that it might be worth some investigation on how field reports are being re-used.

The latest Erfgoedbalans was published in 2017 and contains a section called Digitalisering and Erfgoed (digitisation and heritage). This section states the priority to sustainably store digital heritage, especially since a lot of heritage is 'born digitally' (Ministerie van Onderwijs, Cultuur en Wetenschap 2017, 99). However, all non-digital heritage, such as museum collections, should also be made digitally accessible. Archaeological reports are already stored at DANS in a sustainable way, so that provincial archaeological depots do not have to invest in specific software. The government has started investing in digitalisation projects and intends to create better link connections to combine different cultural infrastructures.

1.3 The grey literature issue

Article 7 of the Malta Convention contains the aim to provide a summary scientific record of every archaeological research that is performed, and to create an overview of all relevant information in order to make the study of archaeology easier and more accessible. The accumulation of archaeological research reports that were never intended for publication is what is known as 'grey literature'.

However, the generating of such excavation reports caused problems in the archaeological field throughout Europe. For with an accumulating number of

excavations performed every year, it seems impossible to stay informed of the contents of all reports and the discoveries that are done. With the intensifying of archaeological field research, archaeologists also published less of their discoveries, as their increased workload did not permit for the synthesizing work (Bradley 2006, 2). The problems faced when working with grey literature were numerous. The first obstacle was getting to know that a report on the subject exists and then to discover its location. The reports were usually printed in only a few copies, stored at universities, museums or heritage agencies (Richards 2017, 228). In the Netherlands a copy of every report was stored at the library of the RCE (Beukers 2009, 40). Grey literature can also encounter the stigma of not being an academic undertaking, but just a technical exercise, meaning that it cannot be used in academic research (Aitchison 2010, 292). Some researchers do incorporate grey literature in their research, although it has been sparsely used in academic research by archaeologists., this has been attributed to difficulty with accessing sources (Aitchison 2010, 293).

The problem of reuse by archaeologists still exist, while the matters at hand have been reputed. Preceding excavations can now be found in digital heritage management systems. With the implementation of documentation standards (especially in the Netherlands) reports have improved so that they are well suited for further research. They have been made accessible for both human use and for computed information management.

One aspect of the grey literature however persists. Even when made accessible by digitalising the reports, and published online in a sustainable repository, a person can never read all reports. This means that not all information can be truly accessed. A report is described by its most important or special features. This metadata is searchable, yet the whole text of the reports is not. However, software developments have led to search engines that can recognize text and read the information that is in them. To gain access to all text within these reports, Alex Brandsen (PhD student in digital Archaeology at Leiden University) is undertaking a PhD research into text mining of archaeological records. He is building a search application called AGNES which will be able to search through all text files in archaeological databases (Brandsen *et al.* 2019, 22). With this instrument he hopes to enable archaeologists to find more specific information for their research, making sure that no information gets lost within the pile of grey literature.

1.4 Methods

To gain insight in the problems of storing archaeological information for future use in the Netherlands the current system will be reviewed, in which a summary record of archaeological excavations, surveys, borehole research and desk studies needs to be submitted to the Ministry of Education, Culture and Science. All finds need to be stored at local or provincial depots and all research data needs to be stored at an e-depot.
In reviewing the system, it is necessary to place it in its historic context, in what climate it formed and why this system was chosen. For its origin had considerable effects on the current state of data storage in the Netherlands. This research will be based on a review of legislation, research papers and state reporting. Another way to attain a clearer view of the way in which article 7 was implemented in the Netherlands was by conducting informal interviews with Valentijn Gilissen, data manager at DANS.
With the system in place for data reuse, it does not necessarily follow that it is used in the intended way. In researching whether the data stored at DANS is being reused, an analysis of user data needs to be carried out. This will be done by quantifying the DANS user data and the downloading and uploading statistics logfiles. This process will be supervised by Henk van den Berg, who is a software developer at DANS. The download and upload statistics of the years 2017 and 2018 will be evaluated. These two periods were chosen because these are the most recent complete years. This research is focused on how the system is currently being used, which is why the most recent years have been chosen. However, while transaction log data have often been used for studying user behaviour, there are some issues/topics to consider (Borgman *et al.* 2015, 2). First, it must be realized that the logfiles are created for management purposes and might not be as compatible for research objectives. Secondly, the account user data of DANS contains personal data of human subjects, all personal data must be anonymized. This will be done by excluding personal information in any user data queries. Finally, the logfiles have limitations of what can be discerned from them, it only reveals what people do, not why they choose to do so.
The final research focusses on how article 7 has been implemented on a national level in other European countries. To obtain insight in these different systems a literature study was undertaken, combined with an exploration of national repositories and national archive web-based systems. As most archaeological data collected in recent years will be born digital, it can be presumed that this archaeological data is also stored digitally. It will be important to discern whether this data is stored in a central repository or stored

in several local digital archives. The only difficulty to be expected is the language-barrier in these systems, this can conceivably be resolved by using translating programmes. By comparing the repositories, it will become possible to answer the question on what differs most between countries in digital data collection.
Researching the international connotations of the implementation of article 7, data has been collected through reviewing European cultural projects, research papers and interviews with Hella Hollander, the head of the data archive at DANS, who has taken part in several European projects in which DANS was a partner. While the project is funded by the European Commission and has several publications, the interviews with Hella Hollander proved invaluable. As an active participant in a large part of the international project, she knows more about the project than can be found in the publications and often knows where such projects stem from. The research will focus on existing cooperation between nations, yet also on why international cooperation is advantageous.

1.5 Research content

This chapter contains a short description of what questions will be answered in the following chapters, which will contribute to answering the main issue of how effective the implementation of article 7 of the Convention is in the Netherland and if it stimulates the reuse of archaeological research data. This needs to be reviewed, for if the archaeological data, which is meticulously gathered, recorded and preserved, is not being used for gaining new archaeological knowledge, it means that the most important scientific resource is not being used. This research delves into the current situation of reusing precious archaeological data and will be considered in the following ways in the coming chapters.
Chapter 2 considers how Malta was achieved and how it was implemented by the Dutch state. It shows the climate in which Malta was formed and how it was put in practice in the Netherlands. Chapter 3 regards the institute DANS, its value to Dutch archaeological practice and how it became the national archaeology repository. It establishes how DANS came to play such a large part in archaeological data management. Chapter 4 is an analysis of user data of DANS. For how is DANS used, how often do people deposit data, how many downloads take place in a year? The answers to these questions can indicate to which extent archaeological data is being reused. Chapter 5 is a comparison of heritage management systems between the Netherlands and other European countries.

By comparing the systems, it can bring issues into focus that might otherwise be overlooked. Chapter 6 is an enquiry of the international accessibility of Dutch data, as per Malta article 8. It shows how it is becoming possible to collect archaeological data from all over Europe. The conclusion of the research is brought together in the final chapter of this thesis, chapter 7.

Chapter 2 The formation of the Malta Convention

2.1 Introduction

This chapter will consider the Malta Convention and how it was formed. It will subsequently focus on article 7 of the Convention, the article that deals with collecting and preserving of archaeological data after archaeological discoveries through the drafting of a summary record. It will then answer the question: How did the Malta Convention, and especially article 7, take shape in the Netherlands? This will be reviewed according to the way in which it was interpreted by the Dutch state. It will also consider the implementation of this specific article into Dutch national legislation. Furthermore, it will discuss the consequences for Dutch archaeological practice, in order to discover what it means to collect all archaeological data in a national database.

2.2 Malta Convention

The Convention for the Protection of the Archaeological Heritage of Europe took place in Valletta (Malta) in 1992. It was adopted on the 16th of January 1992 and became effective on the 25th of May 1995. The Convention soon came to be known as the Malta or Valetta Convention. For clarity the term *Malta Convention* will be used by this author, throughout this thesis.

The Convention was a long time in the making, the first meetings about issues in European archaeology took place in 1988 in Strasbourg (Willems 2007, 58). Present at this meeting was dr. Willem Willems, a project leader at the ROB at the time (he later became director of the ROB) and a professor at Leiden University, who would be involved in all subsequent meeting of the 'Select Committee of Experts on Archaeology and Planning'. The committee was formed in Strasbourg to make a revision of the 1969 Convention of London, which no longer met the requirements of current archaeological practice, besides the fact that it had only been ratified by few countries. The London Convention was the original European Convention on the Protection of the Archaeological Heritage, whereas Malta is the revised edition of the Convention. The London Convention emphasis lies on the preventing of illegal non-scientific excavations, yet it also asserts that states should do anything in their power to enable the dissemination of information on archaeological excavations and discoveries in article 4. However, within ten years of the Convention it was only ratified and entered into force

by 14 states, meaning it did not have a great impact on European archaeology. The Netherlands did not ratify the London Convention at all.

In the 1960s and 1970s the economy was thriving, which led to large scale development and infrastructure projects. This meant that many archaeological sites were under threat and in need of rescue operations. Rescue excavations could only record minimal information of the archaeological site, a feat that was gaining attention throughout the archaeological field in the 1980s (Willems 2014, 152). It was felt that this could no longer continue as a sustainable way of conducting archaeological research and heritage management. This led to a shift of rescue archaeology towards a preventive archaeology system. As Jean-Paul Demoule (a senior member of the Institut Universitaire de France) states in his article on the subject, this is no mere shift of vocabulary, it is an entirely different procedure (Demoule 2012, 612). First, there is rescue archaeology which tries to save whatever possible during its inevitable destruction, usually through a development project. This has little to no influence on this project. Secondly there is preventive archaeology which is included in the planning of a project, making it part of the development and thus has a better chance of recording the archaeological information or even prevent building on the site. This changing role of archaeology and heritage management became a substantial part of the Malta Convention. If archaeology is a part of the original planning scenario, much of the archaeological research can be done before the project starts. This research can lead to archaeologists launching an excavation, advising to relocate the project or giving an all clear for the project. The most important thing of archaeology partaking in the planning of the project, is that it will not be overlooked. This led to the view that archaeology not only exists in excavations but is part of the larger heritage management sector. When an archaeological site's disturbance can be prevented, it now has the chance to be saved, or excavated in a satisfying way.

2.3 Article 7 of the Malta Convention

The most notable section of the Convention text is article 5, which states that archaeology should be an integrated part of spatial planning and that archaeological remains should be kept *in situ* when possible (Council of Europe 1992a). Other notable articles are article 6, implementing the polluter pays principle derived from environmental studies, which in archaeology became the disturber pays principle, and

article 9 creating awareness of the importance of archaeological heritage to the general public. This paragraph will focus on article 7 of the Convention.

Article 7 consists of the dissemination of knowledge about archaeological discoveries and consists of two parts. Paragraph *i* deals with mapping all known archaeological data of a state, to gather all information and bring it up to date. This paragraph is said to be an aid to article 5, for to implement archaeology within spatial planning it is paramount to have adequate information (Council of Europe 1992b). The second paragraph requires states to take all practical measures to ensure the drafting of a scientific summary of the archaeological research. It does not compel states to ensure a further publication, yet only to create short scientific syntheses on which a publication can be based in a further stage (Council of Europe 1992b). This paragraph is also coherent with another article of the Convention, article 9 which refers to the raising of public awareness to create a larger support in the general public.

Finally, article 7 is based on, what in my view is the most important reason for diligent documentation, the inevitability of destructing a site while researching it. Stating that an excavation should always be a scientific endeavour, which obligates the archaeologist to obtain as much information possible for posterity (Council of Europe 1992b).

2.4 The implementation of the Malta Convention into Dutch legislation

While the Dutch government signed the Convention in 1992, it did not turn this into legislation promptly. It took 15 years for the Dutch government to ratify the Convention, which they signed on June 11th 2007 and which became law on December 12th 2007. The Convention was implemented by adapting several articles of the then current Monumentenwet (Raad van State 1988).

To view the implementation of article 7 into Dutch legislation two article of the Monumentenwet will be considered. While many other articles were altered to implement the Malta Convention, and others may attribute to article 7, these will not be dealt with as the main goal of article 7. As such, it will be explored what changes were made to articles 46 and 55 of the Wet Archeologische Monumentenzorg (archaeological heritage law, hereinafter referred to as WAMZ) (Ministerie van Onderwijs, Cultuur en Wetenschap 2007). Article 46 (formerly article 41), deals with the duty of any archaeologist to notify the Minister of Education, Culture and Science of an upcoming archaeological excavation. Several paragraphs have been added to create the new article 46. Of importance is paragraph 4, which states that within two years, the licenced

archaeologist will write a report with the results of the excavation, and will hand it over to the Minister, as well as to the mayor of the municipality in which the excavation took place (Ministerie van Onderwijs, Cultuur en Wetenschap, 2007). The explanatory report embellishes further on this paragraph, in which the mandatory report is called the basic archaeological report (archeologische basisrapportage) (Van der Hoeven 2006, 20). This basic report should be a final report of the excavation, including all accounts of the specialists involved in the excavation, written by the authorised archaeologist. The report should comprise information as such, that it will be able to form the basis of further scientific research. The report must follow guidelines described in the KNA, of which several examples are given (Van der Hoeven 2006, 7). Article 55 states that the minister will maintain a central archaeological information system in which several kinds of resolutions, archaeological notifications and the mandatory basic archaeological reports, will be stored and be made accessible to the public. The explanatory report expresses that this accessibility is imperative because archaeological heritage is an essential public interest. The central archaeological information system that should be maintained is named Archis, an already existing system in which notifications and monuments (at that time) were being collected.

In 2017 a new heritage law came into force; the 'Erfgoedwet' combined six previous laws, including the WAMZ. The WAMZ article 46 became Erfgoedwet article 5.6, with the added paragraph that the minister could make an exception to extend the deadline in which the basic archaeological report should be finished and submitted (Raad van State 2017). Former article 55 has now become Erfgoedwet 5.12 and has remained unchanged. It is further explained in the report that was drafted after the parliamentary questions concerning the new Erfgoedwet, how archaeologists are supposed to act in accordance to storing the archaeological records. The question posed regarded the way in which a lot of effort has been undertaken to create a unified way of reporting on archaeological research, yet there is not one central system to deposit these reports. It is the question whether this would not be a better way of handling the sustainable storage of archaeological research. The Minister explained how the current arrangement is settled as follows (Bussemaker 2015, 58):

> *"In the current system different parties share responsibilities for sustainable storage of digital information. First, there are the provincial depots that manage the storage for digital documentations connected to an excavation and its finds. Subsequently municipalities share responsibility if they have a provincially*

> *recognized municipal depot. The dispatching and storing of archaeological reports are regulated by law through Archis, the archaeological information system which is monitored by the RCE. Finally, it is agreed in the archaeological sector that digital information is also supplied to DANS. […] The government is of the opinion that sustainable storage of digital information is an important aspect of conservation ex situ of the archaeological record."* (by the author).[1]

This agreement in the archaeological sector is established through the KNA, which has several guidelines to conduct proper archaeological research. It can be seen in protocol 4004: Excavating land soils, *part 4 Analysis and reporting*, which provides guidelines for the basic report and which aspects of the excavation need to be recorded (www.sikb.nl). The final step of this part is submitting the report to Archis, within two years after the excavation has taken place. The RCE has a controlling function, it keeps track of the archaeological research being performed in the Netherlands and keeps track of the progress. The RCE has the responsibility to uphold regulations and has the ability to penalize companies who do not hand in the basic report within two years of the archaeological research (Rijksdienst voor het Cultureel Erfgoed 2019, 6). Next, in *part 5 Deposition* (www.sikb.nl) it is described what steps need to be taken prior to the mandatory deposition of digital archaeological data in an e-depot. As DANS is currently the only qualified e-depot in the Netherlands, this can be read as an instruction to deliver all digital data to DANS EASY, to provide sustainable storage.

2.5 Consequences for Dutch archaeology

While archaeology became an international matter with the Malta Convention, archaeological heritage management systems differ tremendously between nation states (Webley *et al.* 2012, 2; Willems and Van den Dries 2007, 4). A division arose of public versus a commercial archaeological system throughout Europe. The public system is a centralized system, in which the state regards archaeological heritage as a topic governed by the state, who sets the rules and undertakes archaeological research. In the

[1] Original text: *"In het huidige stelsel hebben verschillende partijen een verantwoordelijkheid voor duurzame opslag van digitale informatie. Op de eerste plaats zijn dit de provinciale depots die zorg dragen voor de opslag van digitale documentatie die verbonden is aan de opgraving en de vondsten. In het verlengde daarvan hebben ook gemeenten hier een verantwoordelijkheid voor zover gemeenten beschikken over een door de desbetreffende provincie erkend gemeentelijk depot. De aanlevering en de opslag van archeologische rapportages is wettelijk geregeld via Archis, het archeologisch informatie-systeem dat wordt beheerd door de RCE. Tenslotte is de afspraak in de archeologische beroepsgroep dat digitale informatie ook wordt aangeleverd bij DANS […] De regering is van mening dat duurzame opslag van digitale informatie een belangrijk onderdeel is van het streven naar behoud ex situ van archeologische informatie."*

commercial system, it is believed that archaeological heritage should be left to the principles of a free market economy. The Dutch system is somewhere in between these two policies. Archaeological research in the Netherlands is performed by commercial companies, with a central organisation of quality control and excavation standards regulated by the state (Van den Dries 2011, 595). The quality control depends on a self-regulating mechanism of the archaeological sector.
While previously academic institutions carried out most excavations, archaeological research is currently usually contracted out to private businesses (Demoule 2012, 611) that need to comply to the national guidelines as stated in the Dutch KNA, and accordingly write and submit a basic report to the state.

2.6 DANS

By making archaeology part of the spatial planning process archaeological research has developed substantially. With this great increase of archaeological research and increase in written reports with its accompanying data, the need for a suitable storage facility followed. The Dutch monuments law called this the central archaeological information system, which was named as being ARCHIS in the explanatory report. This however, is not the total picture of storing archaeological data and making it accessible to the public. Archis is not suitable to store datasets for the long term, it was meant as a system to contain excavation information, locations of individual finds and information on artefacts. From 2007 on it is compulsory for all archaeologists to store all the archaeological basic reports into a system at DANS which functions as a digital archive (www.dans.knaw.nl). DANS is an institute that makes digital research resources permanently accessible, storing archaeological data in this repository was meant to attribute to reusability of the excavation data.

2.7 Conclusion

The implementation of the Malta Convention was shaped by the cooperation of the Dutch state and archaeologists. In view of the problems that archaeologists were facing, a plan was made to counter these issues. With archaeology becoming a commercial endeavour there was a risk of archaeological companies having to economize on excavation methods, or the writing of excavation reports. There is a conflict of interest between the building companies and archaeologists. The construction company wants to lose as little as possible in funds and time and its core project gains nothing from

properly executed archaeology. With pressure from these companies, archaeologist might not be able to execute adequate research and documentation. This has been prevented by implementing a self-regulating system of KNA standards, which archaeologists need to follow. This is upheld by the state, who commands that all archaeological reports should be entered into a national archaeological information system within two years after the completion of the archaeological research. As state department the RCE has the authority to fine archaeological companies that exceed the time limit of two years of handing in their final report. As such, the archaeological system in the Netherlands is a cooperation of the state, that is actively involved in preserving archaeological remains in the Netherlands, and a market driven archaeological sector.

Yet, does this use add up to the main goal of article 7 of the Malta Convention? To answer this question, we must look at *how* DANS is being used, by both sides of the system. We must consider how data is presented in DANS and is being made accessible to its users. Further, the way in which DANS is operated by its users should be examined, how many datasets are downloaded each year, which kind of profiles do the users have. These are aspects of the archiving system that will be explored in the next chapters, in which data about the use of DANS will be analysed. This is done to evaluate the use of a national archive in facilitating the study of archaeology and creating new archaeological knowledge.

Chapter 3 The DANS institute

3.1 Introduction

What does the DANS repository add to Dutch archaeology data storage? In case of an excavation, the report and digital data — together with the artefacts — are all that remain of the original site, which makes it imperative to store the information properly. Can this repository be an extension for creating new archaeological knowledge? This can only be accomplished if the data that is stored in DANS can be used by archaeologists in their research, making accessibility a prime prerequisite. For data should be considered as an equally important possibility of gaining new understanding of the past as new excavations. The accumulative data on geographical distribution of artefacts and structures, photos of the soil layers, material find databases etcetera are all components of archaeological research that can be reinterpreted and should be treated as having as much value as the artefacts themselves.

DANS is an institute that falls under the NWO (the Netherlands Organization for Scientific Research) and the KNAW (the Royal Netherlands Academy of Arts and Sciences) both of which are institutions that were created to promote quality in science and scholarship in the Netherlands. They have a vision that scientific research can and should contribute to society as a whole, and connect researchers from industry, the government, societal organizations and universities (www.dans.knaw.nl/en). Within this construction, DANS is part of the infrastructure division, storing scientific research sustainable and accessible. DANS has three main pillars of data storage, a short-term data management system DataverseNL, a national portal to access research information called NARCIS, and a long-term archiving system called EASY. The focus of this thesis is placed upon the latter, for this portal is used in national archaeological data management. Datasets, containing multiple and different kind of files can be stored in EASY. DANS uses the term dataset, which correlates tot the term “collection” in the Dublin Core Metadata Initiative terminology (Borgman *et al.* 2019, 6). The Dublin Core standard is a broadly applicable metadata vocabulary system, that is easily employed for machine readability and is widely used as standard for archives and repositories.

3.2 Other data storage facilities

DANS is not the only storage facility for digital data in the Netherlands. All research data is also stored at regional depots together with archaeological artefacts in case of

excavation. Another storage option for digital data is with the municipality in which the research took place. Finally, data is also stored at the RCE in Archis. While it is important that the research data and excavation report is kept collectively with the archaeological finds, such as artefacts, soil samples and non-digital data in the regional or municipal depots, it is also challenging to find data from several different depots.

3.2.1 Municipalities

For municipal depots, over half of the digital data is stored on the local server by the depot staff members (Erfgoedinspectie 2018, 48). These systems of storage vary in each municipality, which means that most information is difficult to access without the specific knowledge of the depot employee. In less than half of the municipal depots, all digital archaeological data is handed over to the IT-department, which in some cases will work together with the municipal archive unit (Erfgoedinspectie 2018, 43). By handing it over to IT, the depot ensures the sustainability of the data, it also is a further splintering of archaeological information. Many municipalities have started building their own e-depots, as a project for the municipal archives but could also include archaeological data storage. This local e-depot would supersede the need to place archaeological data in other e-depots, such as DANS. For according to the KNA, it is required to store research data sustainably in an e-depot; it does not specify which depot that needs to be (Erfgoedinspectie 2018, 45). The different ways in which the municipalities store their digital archaeological data makes it difficult for external researchers to find what they need. This way of segregating archaeological data per region would not be favourable for the disclosing of archaeological research.

3.2.2 Provincial depots

The storage of digital archaeological information also takes place on the level of provincial depots. One of the problems that these depots are facing is the fact that they cannot open and read all digital information that is handed in, as they do not own the accompanying software. The commercial archaeological companies often use archaeology specific software such as AutoCAD or MapInfo for graphic map drawings, this software is not available to all provincial depots (Erfgoedinspectie 2016, 60). Another issue that the depots are facing lies in the fact that there is no united policy in making the data sustainably accessible. Data that is delivered to the depot is stored in different ways, for example: by storing it on a local computer and keeping the original

disc or USB in the analogue depot; storing the data on the provincial server, which effectively gives the responsibility for maintenance and back-ups to the IT-department; or even making a back-up on external hard drives by depot employees, which needs to be backed up manually (Erfgoedinspectie 2016, 59-60). There is a new development in the provincial depots, to standardize the way in which data is delivered. It has started a project called Depot Management System (Depot Beheer Systeem; DBS) (the information on the DBS project was obtained in an interview with V. Gillisen, archivist at DANS). The DBS project started during the year 2017, it however has still not been incorporated as standard data entry at this time. The DPS is a standardized way in which archaeologists use a software device called the Pakbon, a kind of packing slip, which automatically generates the right metadata words or phrases from the actual dataset. By using the pakbon, the dataset is described and makes it possible to do an automated data deposition, which save the depositor of doing manual metadata entry. Subsequently, the provincial depots deposit all data for durable storage at DANS. On completion of the DBS, all archaeological research data can be deposited through the provincial depots, which would make it no longer necessary to also store the information at DANS. This completion has at the moment not been reached. Currently the provincial depots are still difficult to access for external researchers, because of their diverging ways of data storage.

3.2.3 Archis

The Archaeological Information System is the national system in which monuments, reports of isolated finds, and excavation reports can be found interlinked with their geographical location. It is possible to view different map layers and it can show different kinds of information. It is also possible to use as an archaeological database, in which several kinds of information are represented. Every mention of archaeological excavation or monument has its own registration or case number, to ensure that all registrations are unique. These registration or case-numbers all contain their own metadata, which complies with the Archeological Basic Register (Archeologisch Basis Register; ABR). This makes Archis an asset to preliminary archaeological research and desk studies. Having all information of Dutch archaeology in one system on an interactive map gives an immediate overview of the area that is being researched. The information that Archis holds per registration number is summary. The registration holds several metadata fields, and in the case of excavations of the past twenty years it

contains a link to the excavation report. In contrast to the depots and the e-depot at DANS, it does not hold all digital research data. Databases with precise information on the artefacts, soil information and georeferenced databases etcetera are not included in Archis. Unless it is part of the excavation report, such research data cannot be gathered from Archis. As the system is not able to be used for reinterpretation, analyzing and reuse of the original research data, Archis will not be considered further in this thesis.

3.3 EDNA

To understand how EASY came to be the national digital archive for archaeological data we first need to look at a project called EDNA, the e-Depot for Dutch Archaeology that started in 2004 as a collaboration between Dutch universities with archaeology departments, the RCE, and NIWI (National Institute for Scientific Information services), a predecessor of DANS. In this period many backlogged digital Dutch archaeological data became archived in EASY. For this projects floppy discs and CD-ROMs were collected and their contents stored, but also physical maps and reports were scanned in a massive scanning project (Gilissen 2013, 42). Especially excavation reports, the so-called grey literature, were digitized in large numbers. Formerly, these reports would be stored at the ROB (Zoetbrood *et al.* 1997, 330) and one copy would be kept at the institute that handled the excavation, usually a university or a museum. Here, the report could only be accessed manually (Zoetbrood *et al.* 1997, 333). As such, the archaeological information that was gained during the excavation was nearly inaccessible, while the site was destroyed forever. The best-case scenario was for the information to be accessed via the people that were present at the excavation, gathering information through human storytelling. Not an ideal situation to conduct research, for the researcher had to do a lot of work that had already been done before, and the information could not be accessed easily. It should be remembered computers were scarce and the internet hardly existed in this time. The accessibility and structuring of information have profoundly altered with the start of the digital age (Johansen and Mogren 2014, 146). The EDNA project, with the digital archiving of backlogged excavation reports, scanning of old maps and paper files, made a lot of previously unobtainable information accessible for researchers. This was the first step in countering the issue of unavailability of archaeological information.

3.4 EASY

In 2005 DANS became the successor of NIWI, with the goal of archiving all humanities scientific datasets in the Netherlands, beta sciences usually already had repositories in place. Subsequently EDNA was incorporated within DANS EASY (Electronic self-Archiving System) as a definite part of the organization. Thus, storing data sustainably, to enable scientific data to survive technical innovations and making it accessible for scientists to incorporate old data into new research. In 2007, with the implementation of the Convention of Malta in Dutch legislation, it became mandatory to store all data from an archaeological investigation into a national trusted digital repository. These investigations vary from borehole research, field surveys, desk studies to archaeological excavation, containing GIS files, databases, vector maps, photos, and final reports. In the Netherlands, the only archive that has this certification is DANS, meaning that all datasets from archaeological investigation need to be stored in EASY. Currently, there are nearly 40,000 archaeological datasets digitally archived (www.dans.knaw.nl, in March 2019). These datasets are very heterogeneous in kind, there are datasets that contain thousands of files, while others consist of one PDF file of the final report.
EASY is a self-archiving system, meaning that the archiving system relies on users to upload the data, including the appropriate metadata. To accomplish this, DANS tries to convey this task as clear as possible. To aid the contributors of data, there are guidelines on the website of DANS in both English and Dutch. DANS also offers a course in storing data sustainably, called *Essentials 4 data support*, and assists universities and foundations in developing a research data management policy (www.dans.knaw.nl). To maintain a coherent archive which will remain accessible in the future, several provisions are taken. Data should be submitted in preferred format, or accepted formats, to assure longstanding usability (Hollander 2017), see figure 1.
These formats are chosen for their durability and independency of software formats. The metadata fields conform to the international Dublin Core standard (Gilissen 2013, 42), which makes it possible to create a linked data system.
In 2016 DANS was granted the Nestor Seal, a German Certification standard for digital repositories. Several years were spent on attaining this goal and in 2016 DANS was the first digital repository to be granted the seal. This prestigious certificate means that the institute has reviewed its entire organization, followed the DIN31644 criteria for trustworthy archives, and has a preservation plan in place. The Nestor seal can only be earned by self-reviewing the entire archive system followed by an external review,

which forces the organization to think about all possible issues that can arise now and in the future (Gilissen and Hollander 2017, 195).

Another important part of making the dataset durably accessible is the creating of Persistent Identifiers. This means that the metadata page has a permanent DOI link, which will remain the same even if the DANS webpage is altered or changed. As such, one can use a dataset for one's own research and use a permanent identifier link in the literature list. This link will still lead to this same dataset years after its initial use, making the data verifiable and reusable in the future.

Type	Preferred format(s)	Non-preferred format(s)
Text documents	• PDF/A (.pdf)	• ODT (.odt) • MS Word (.doc, .docx) • RTF (.rtf) • PDF (.pdf)
Plain text	• Unicode text (.txt)	• Non-Unicode text (.txt)
Markup language	• XML (.xml) • HTML (.html) • Related files: .css, .xslt, .js, .es	• SGML (.sgml)
Spreadsheets	• ODS (.ods) • CSV (.csv)	• MS Excel (.xls, .xlsx) • PDF/A (.pdf) • OOXML (.docx, .docm)
Databases	• SQL (.sql) • SIARD (.siard) • DB tables (.csv)	• MS Access (.mdb, .accdb) (v. 2000 or later) • dBase (.dbf) • HDF5 (.hdf5, .he5, .h5)
Statistical data	• SPSS Portable (.por) • STATA (.dta) • DDI (.xml) • data (.csv) + setup (.txt)	• SPSS (.sav) • SAS (.7dat; .sd2; .tpt) • R (* under examination)
Raster images	• JPEG (.jpg, .jpeg) • TIFF (.tif, .tiff) • PNG (.png) • JPEG 2000 (.jp2)	• DICOM (.dcm) (by mutual agreement)
Vector images	• SVG (.svg)	• Illustrator (.ai) • EPS (.eps)
Audio	• BWF (.bwf) • MXF (.mxf) • Matroska (.mka) • FLAC (.flac) • OPUS	• WAVE (.wav) • MP3 (.mp3) • AAC (.aac, .m4a) • AIFF (.aif, .aiff) • OGG (.ogg)

Figure 1 Part of the Preferred format list of DANS, https://dans.knaw.nl/en/deposit/information-about-depositing-data/before-depositing/file-formats

3.5 FAIR

The goal of DANS is making all Dutch research data accessible, to enable greater and better possibilities for future scientists. While being a young organization, DANS has an extraordinarily deep perspective. By creating a digital archive many new obstacles need to be overcome. For DANS does much more than just 'keeping' the digital files that are

given to them by scientists. The data must be stored in such a way that it can still be accessed and understood many years in the future. To enlarge the quality of data, DANS has embraced the FAIR principle. FAIR stands for Findable, Accessible, Interoperable and Reusable and is an internationally applied model to improve the infrastructure of scholarly data (Wilkinson *et al.* 2016, 1). There are several ways to implement these principles within digital repositories, to make archiving a more integrative part of scientific studies.

3.5.1 Findable

For data to be reused, it is essential that it can be found. First, this is achieved by assigning metadata to the files. Metadata is, simply put, information about information; the subject of the research, its location, the method of collection. It is a short description, in key words and a short summary, that expresses the subject and anticipates what kind of terms someone would use when trying to find this data. For improved findability, metadata should be added in a standardized way, to describe everything consistently. This means that the choice of metadata fields should be considered. Several fields like title, creator and date are be obligatory, while other fields, which could be more specific to research areas, could be optional. DANS has followed the Dublin Core Metadata fields, making some metadata fields a requirement, while other remain non-obligatory. Secondly, data should be assigned a permanent identifier, making data traceable and accessible online in the future. This is done by DANS through giving the data a Digital Object Identifier, which is described as:

> *"a code used to permanently and stably identify (usually digital) objects. DOIs provide a standard mechanism for retrieval of metadata about the object, and generally a means to access the data object itself.* (Wilkinson *et al.* 2016, 2)

DANS first used URN: NBN identifier (Uniform Resource Names: National Bibliographic Number) which is commonly used by national libraries (www.kb.nl). Yet, it also uses DOIs, at the request of the scientific community (www.netwerkdigitaalerfgoed.nl). Lastly the persistent identifier should always be named in the metadata and cited in further research.

3.5.2 Accessible

The next step in the viewing, evaluating and reusing of data is making it accessible for those who might want to use it. Making data accessible is no easy feat; there are many things to consider, like the legal implications of ownership of the data, or sensitive or personally-identifiable data and the General Data Protection Regulation (GDPR; Wet Bescherming Persoonsgegevens). For these issues there are several solutions in order to make a dataset accessible. In the case of copyright issues, or an author wanting to publish about his research, data can be placed under embargo. This means that the metadata can still be found and accessed, but the dataset itself is closed for a specific time after admission, when this period has passed the dataset is automatically made public. Another way to restrict access to a dataset is authorization, creating a system in which the person who wants to access the dataset has to request permission from the creator. This enables the owner of the dataset to either grant permission to the whole, or part of the dataset. For this the owner may request information on what his dataset will be used for and which section you might actually need. When uploading datasets into EASY it is a requirement to comply with the license agreement. This agreement states that the dataset may not contain information that is in violation of Dutch law, including the Personal Data Protection Act of the Netherlands.

3.5.3 Interoperable

Interoperability is defined as *"the ability of data or tools from non-cooperating resources to integrate or work together with minimal effort"* (Wilkinson *et al.* 2016, 2). To integrate resources with minimal effort the evident choice is to make use of computer software to combine and extract data. To make this a possibility, currently and for the future, several data standards have to be considered. The most important part of interoperability is standardization. To make data searchable for APIs (Application Programming Interface) there should be commonalities within in the datasets. Within archaeology standardization is already implemented in several stages of research projects. This includes the KNA guidelines and standard terminology in reports, databases and metadata. Because of this accepted format of phrasing objects and materials in a specific jargon, searching and combining these terms through machine actions is made simple. In the Netherlands the Archaeological Basis Registry thesaurus is used throughout the archaeological sector (as can be found in the Preservation plan of DANS www.dans.knaw.nl). To ensure the use of this vocabulary in the metadata when

depositing data in EASY. When ascribing the domains of the dataset one needs to choose from a table in a dropdown menu, with a choice from multiple domains being an option. Another way standardization is implemented is within the dataset, by following the SIKB guidelines (SIKB KNA leidraden) ensuring that all archaeological research data is presented in a uniform way. This secures that all archaeological reports follow the same procedures and steps throughout the process. For this purpose, the SIKB has written guidelines for several different archaeological investigations (www.sikb.nl), including borehole research, excavating under different geological circumstances and more. These guidelines will ensure systematic accounts of the research, even in varying circumstances.

Another way to realize interoperability, is the standardization of file formats. By ascribing specific files formats for specific categories, a uniform system is created that is easier accessible for APIs. These file formats need to be future-proof to make these files accessible for future use.

The standardization of archaeological data is what makes it interoperable, for when every certain type of documentation is described according to national guidelines it becomes possible to compare and combine these types of documentation. What needs to be recognized is that uniformization of data creates monotony. The emphasis in documentation in the Netherlands has been placed on standardization. These procedures can however suffocate the academic interpretations in research and may lead to a "industrialization of history and culture" when this limitation is not acknowledged (Johansen and Mogren 2014, 144). When this consideration is neglected, it can lead to increasingly generic reporting of archaeological research. A feat that all archaeologists need to be aware of, to ensure that standardization does not simply lead to duplication of data.

The standardization of data and data storage can make the analysis of big data possible and makes scientific research more open. For when data from archaeological research is made accessible to all, it also makes it verifiable. When entering data in a uniform way into a repository, it becomes possible to use machine learning to analyse the data.

An example of interoperability is the use of the *pakbon*, within archaeological deposition in EASY. The *pakbon* is a software programme that reads the data that is entered and fills in some standard metadata fields, such as author and title. The use of the pakbon has made self-archiving a lot easier for the depositor; when such tasks can be performed by software, there will be more time left for the interpretation of data itself.

3.5.4 Reusable

Finally, all data should be stored in such a way that it becomes a reusable source. To ensure this process the following should be considered: systematic documentation, the use of common and durable file formats, protecting the integrity of datasets and assuring licensing rights. To make data reusable in the future, DANS addresses the issues by taking several precautions. To create a user-friendly dataset, it is recommended that all similar files are stored in one folder. All depositors are advised to deposit their different files in a commonly used folder that divides photographs, reports, databases and geographical information. Another precaution is the preferred file format (see figure 1), specified in the file formats page of the DANS website. The preferred file formats are based on three Conventions, the formats need to be "[1] frequently used, [2] have open specifications and [3] are independent of specific software or developers" (www.dans.knaw.nl). All three are adhered to when possible.

Preserving the datasets integrity is another concern for long-term reusability. For the dataset, once deposited, should never be altered, not even to incorporate new insights or supplement the dataset. All subsequent research that had been done on account of this data could become invalid if the original dataset would be altered. It is paramount to maintain data, once deposited, in its original form. Even when the creator of the data finds an error in his own data, the rectifications should be in a new deposit with a reference to DOIs of the original dataset in the metadata.

When depositing data for long term storage and reuse it is important to consider data usage license. It should be specified who holds the ownership rights, type of copyright and accessibility of said data. This is discussed in the license agreement of DANS when depositing data. In the agreement it is stated that the creator of the data retains ownership, that the creator can restrict access to their research when required and that DANS is non-exclusive, leaving the creator free to place his data in other repositories. When minding durability of file formats, maintaining the integrity of deposited files and making clear arrangements on license issues, the repository will render the files reusable. Together these aspects of data storage ensure its practical use for future researchers.

3.6 Access to datasets in DANS EASY

The use of DANS is always free, for both the downloading of data as for depositing of datasets. This means that there are no fees attached to the use of DANS, to make research data as accessible as possible.

When depositing archaeological data into DANS the depositor has a choice about granting access to their data. They can decide to make the data open for everyone who is interested, restrict access to a group of professional archaeologists, share on request or place an embargo for a specific period with a maximum of two years.

DANS has an open access program for all datasets, meaning that they prefer to make all data open access to anyone. As such, currently the metadata of all datasets is accessible, while gaining access to the actual data can only be achieved by registering a personal account at DANS. To register an account, one has to go through a straightforward procedure, which is easily accomplished in mere minutes, and which creates a usable account instantly.

Researchers can opt for restrictions on their datasets. The wish to restrict data can arise from a variety of reasons. One such example is research concerning human subjects, which usually contains sensitive information. In order to comply with the GDPR, such information should not be made public. To ensure this, the research should be either anonymized or have restricted access. Within the discipline of archaeology however, this is not a very common occurrence. Placing an embargo on data is usually done by scientists who want to publish an article or book on their data and do not want other researchers to publish about it before they do (Borgman *et al.* 2019, 14). The other restriction options are only making the data accessible for the restricted group of archaeological professionals or adding a request option to require the data. Both options were designed to gain as much datasets as possible, while leaving the creators of the datasets with a sense of control about *their* data. For example, one depositor restricted the access by making it a request-access, he stated that he felt that it was no help putting all his files online and that researchers could only get lost in the magnitude of number of files. If someone wants to access the data, that person can put in a request, and the creator can help by pointing them to those specific files (Borgman *et al.* 2019, 14). The archaeologist from this example felt a strong sense of ownership for his research and felt the need to govern his own data. In the agreement with DANS when storing data in EASY, stewardship of the data will befall onto DANS when the owner of the data cannot be contacted or has passed away.

In the other case of restriction, archaeologists did not so much want to keep control of their data, but keep some information out of public knowledge, like the exact location of an archaeological site, fearing that hobby archaeologists with metal detectors would go to these sites and illegally excavate artefacts. This belief is no longer supported by most archaeologist. A good example of the current close collaboration between archaeologists and metal detectorists can be found in the Portable Antiquities of the Netherlands project (www.portable-antiquities.nl).

To keep some datasets out of public knowledge an archaeological group modus was created for DANS accounts, in which any account could request permission to be added to the group if they could demonstrate that they worked or studied within the archaeological field. Access is usually granted based on an e-mail account belonging to an excavation company, museum, university or other affiliated institute. This last option of restriction to the archaeological professional group, was primarily chosen by archaeological companies, preferring to keep archaeological data from non-archaeologists.

DANS however promotes open access for all datasets, asking —when possible— to choose the open access option when contributing data. In the early stages, open access was considered everything without restriction, after the registration of an account. Currently, it is not considered that open access datasets, which requires registration, are truly open access. In their aim to make all data open access they have approached several archaeological companies and asked whether they would consider changing the status of their depositions from restricted to non-restricted (Borgman *et al.* 2019, 15). With the archaeological sector getting accustomed to depositing their data and reusing this data, many companies agreed. This coincided with the general movement in scientific research, in which many institutes that give research grants require the researchers to deposit their data in a trusted repository (Aspöck and Geser, 2014, 5; Wilkinson *et al.* 2016, 5). Presently the Open access CC Zero option – which waives all possible rights to the dataset – is gaining in popularity.

3.7 Conclusion

Being part of the KNAW and NWO, DANS has established itself as a critical part of archaeological data storage in the Netherlands. With the impulse of data collection in the EDNA project, archaeological research has become a considerable component of the datasets within EASY. From 2007 on, all datasets concerning Dutch archaeological research needed to be stored in the e-depot, which meant that not only reports but all digital research data was stored in EASY.

While the option of storing archaeological data at regional levels remains, this often only leads to data being stored in a non-sustainable way in municipalities. By depositing the data at municipalities, the data itself, but especially the metadata is at risk of disappearing entirely. The DPS project is a way to resolve this existing issue.

DANS does many things to create a durable archive for the future. By doing so, it has created a system in which data is freely accessible and creates the possibility for the reuse of data. For not only the storing and preserving of archaeological data deserves consideration, it should be aspired that this data should be made available to be used again in new research. For not only artefacts that are discovered during excavation have scientific value after the original unearthing, the data about the archaeological excavation is also of great importance.

By following international standards of digital archiving, it has become a trusted digital repository and has gained the Nestor seal, an international certification for digital archives. By making data in EASY FAIR it shows that DANS is actively engaged in making the data in the repository durable and usable for posterity.

The systematic collection and presentation of data in archaeological research following KNA-guidelines combined with the interoperability of the FAIR principles, should be monitored closely. With the emphasis in the Netherlands being on standardization, there is a risk of creating generic archaeological reports, that leave no room for deeper academic analyses by archaeologists. This should also be considered of the computerizing of data deposition at DANS, until machine learning has evolved to the level that it can differentiate nuances in texts, it cannot be used to fill in the metadata fields of archaeological research. The assessment and assigning of specialized metadata terms should currently remain a human undertaking.

As long as awareness of these concerns remains present, the deposition of archaeological data will be secured for future uses. DANS is committed to contributing to make archaeological data accessible for future researchers. Future archaeologists can

gain new archaeological insights by studying old excavation and prospection reports. In short, DANS ensures the safeguarding of digital archaeological data, which makes it possible for other archaeologists to use this data in future endeavours.

Chapter 4 Dans user data

4.1 Introduction

As has been seen in the previous chapter, archaeological data for sharing and disseminating of archaeological research in the Netherlands is mainly stored at DANS. By looking at how this came to be the archaeological e-depot of the Netherlands it became apparent that the institute is a digital archive which aims to make archaeological research sustainable and reusable for future generations. While having such a repository in the Netherlands is of course an improvement to the former situation in which paper reports had to be stored at the RCE, the digital archive also needs to be used by archaeologists and interested parties for it to be a true asset within Dutch archaeology. This leads to the question: To what extent is the archaeological data stored at DANS being reused? To answer this question, we first need to determine how and by whom the repository is used. This research is based on the user account data and logfile data of the DANS EASY repository. [2] The data has been provided by DANS and shows data of all present scientific disciplines, for the sake of this research archaeology is displayed not as part of the humanities, but as its own field of study.

4.2 The definition of reuse

First, it is important to establish what is meant by the term reuse in connection to the reusing of data. The text of article 7 states that archaeological information is to be gathered "For the purpose of facilitating the study of, and dissemination of knowledge about, archaeological discoveries […]". In this thesis the study of archaeological discoveries is regarded as the reusing of archaeological data from previously executed research. The study of archaeological discoveries is measured by the act of downloading

[2] To access the user data of DANS, the author has performed an internship at DANS in The Hague during the period of March and April 2019. The following will analyse and interpret the user data of the years 2017 and 2018 and aims to assess whether DANS is an effective medium for the reuse of archaeological data. All use and user data have been specifically gathered for this study of the implementation of article 7. All corresponding data and graphs have been created for this study and has not been published elsewhere. Data from this research can be requested at DANS.

archaeological information from the DANS repository. When examining the download statistics from DANS, the downloading of a single file is recognized as an action of reuse. Downloading a file is an active way of gathering information, for this cannot be done accidentally. To come to a downloadable file, the user already searched for the information on a region, time-period or specific site, had to open the record that meets its requirements and continue to the data files, only then a file can be clicked to download. This is not a process that someone would undergo without the goal of gathering information. One might see a scenario in which some depositors will want to check whether their deposit was successful and might download their own data and that such an action is regarded as reuse. However, whether this is the case will also be contemplated during this study.

4.3 DANS accounts

To gain access to datasets within DANS, anyone can register an account at DANS to access datasets. There is also a possibility to gain access without an account, yet there are currently (August 2019) only 8375 datasets (9% of the total datasets) available to users without an account. After this there are several restrictions possible, specifically: closed to all, open to all, open for registered archaeology group, restriction through needing to request permission or being placed under embargo for a maximum of two years. For this research it is very useful that DANS has user accounts in place, for it can give an insight into different kind of users of the data, who they are and what they use DANS for.

As DANS is not just a medium for archaeological data storage, we first need to filter out the users who are not interested in archaeology. The information gathered on user accounts has been collected in March of 2019 and consisted of 18,092 user accounts in total for all research disciplines. This number of accounts is deemed an accurate representation as there has been an inventory of accounts in 2016 in which non-active accounts were deleted.

When looking at the account of DANS there are two things that are of interest for this research; if the user is interested in archaeology and if they are part of the archaeological professional group. When registering an account at DANS an optional field is to enter a disciplinary interest in a specific scientific field. Archaeology is one of the options, but how many of the accounts have this field filled as archaeology? Another option is to become part of the archaeological professionals' group. This group was

especially made for archaeology within DANS and was meant to be an exclusive group of people who work in the archaeological sector. This was done because it was feared that metal detectorist would use the available locations to revisit the site in hopes of finding artefacts, a notion that has since then been abandoned. Especially with the successful cooperation between archaeologists and metal detectorists in the Portable Antiquities of the Netherlands project (www.portable-antiquities.nl).

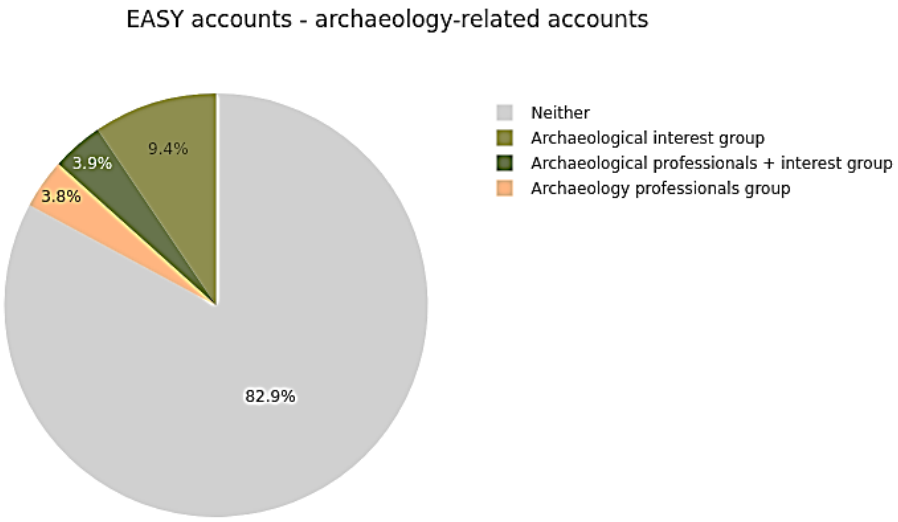

Figure 2 Archaeology-related accounts, graph created by DANS for this study

When we combine the accounts with the discipline or group settings, we can see how many of the accounts are people who want to know more about archaeology. To this effect a query was written to find out how many of the accounts within DANS have one of these two things in their account. The results were somewhat disappointing as nearly 50% of all accounts have not filled in any scientific discipline as particular interest. Meaning that half of the accounts cannot be given any particular research interest, and therefore cannot be attributed to anything This might be resolved by making it obligatory for users to enter a specific research interest. Of the 8983 accounts that did fill out a discipline, 2419 had ticked the archaeology box as their research interest. When delving further into the account data it could also be established how many of the accounts had either research interest archaeology, was part of the group archaeological professionals, and those who were both, this is shown in figure 2.

This chart shows that 17 percent of all EASY account have either the interest in archaeology, are registered in the archaeological professional group or both. The remaining 82,9 percent of the account have none of these. This means that one sixth of

all accounts are decidedly archaeology-related, with the possibility of more accounts without preferences being interested in archaeology.

4.4 Download data

Something completely different comes from examining the component of archaeology when looking at downloads divided into different disciplines. To get user download data the statistics log was needed. For this research the choice was made to look at the most recent data from the previous two years, 2017 and 2018. The data from these years are arranged by year, to see the difference a year can make. This does not mean that any trends will be noticeable, for two years is too few to conclude ongoing trends.
When retrieving the data from the statistics logs it became clear that a few days were missing from both 2017 and 2018. In 2017 there were 36 days missing, and in 2018 19 days were missing. The absent days can be ascribed to small system failures, updates that did not go accordingly, or days that the system did not function for a part of the day. These missing days are interpolated as to ensure that the missing days were not seen as days in which nothing was downloaded. For in 2017 10% of the days is missing, that would have a considerable effect on the dataset.
The user download data subdivided into specific disciplines gave the picture shown in figure 3. This overview shows the download of datasets, this means that as the whole dataset, or part of it was downloaded, this is noted as one event. It is important to observe, that while archaeology is usually considered to be part of the discipline of humanities, in this research archaeology has been taken as a separate discipline. As is seen in the graph this is to a considerable effect, for the archaeological download numbers are far higher than any other fields of study. In both 2017 and 2018 this comes to 34,000 downloads per year.
Another important consideration is the number of files that are downloaded for each discipline. For the archaeological datasets that are stored at DANS vary considerably, with some datasets containing one file, while others consist of hundreds of files. In figure 4 the separate files which have been downloaded are displayed.

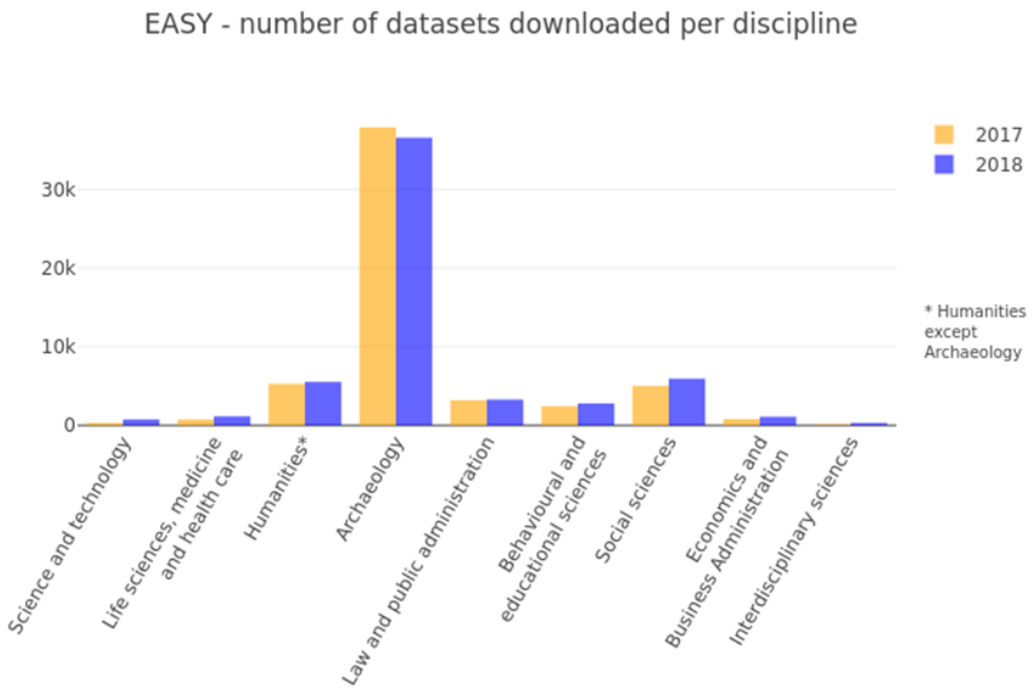

Figure 3 Number of dataset downloads per discipline, graph created by DANS for this study

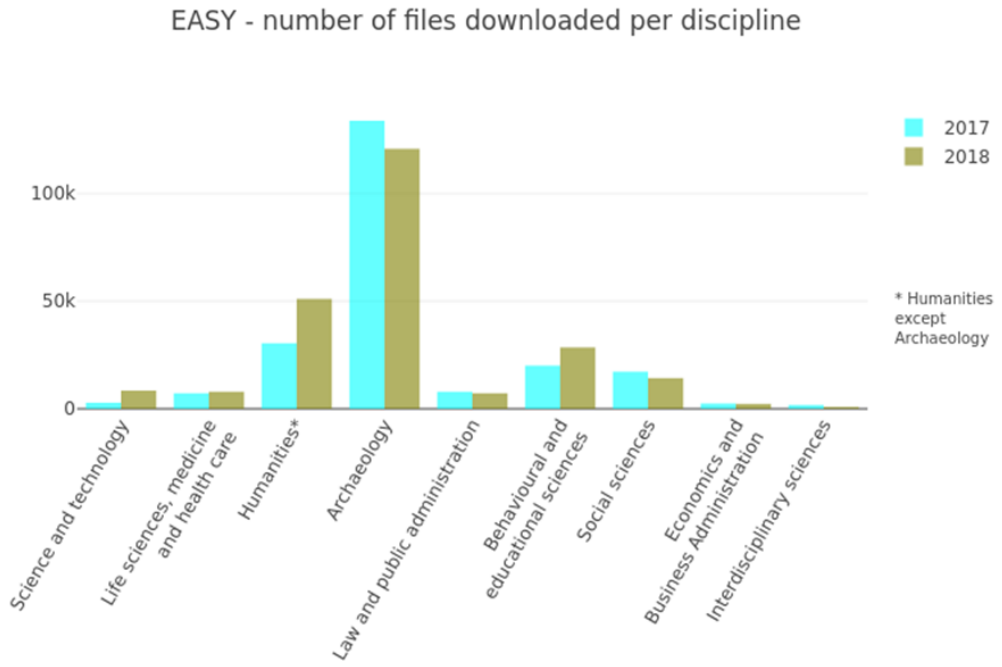

Figure 4 Number of files downloaded per discipline, graph created by DANS for this study

As becomes clear, archaeology continues to have the largest bar in the graph. It shows that in 2017 there were some 133,000 files downloaded in archaeological datasets, coming to an average 3.5 files per download. The uploading of files through deposition will be considered in paragraph 4.6 depositor data. In 2018 it was slightly less with 120,000 downloads, which comes to an average 3.3 files per download. Yet, the statistic logs have shown that in 91% of events, only one file was downloaded. This would mean that in the remaining 9% of events, multiple files were downloaded.

To see how the archaeological downloads relate within the whole of DANS download statistics a comparative graph was made which is shown in figure 5 per download event and in figure 6 per files downloaded. The total amount of downloads is shown in table 1. What becomes clear from figure 5 is that more archaeological datasets are downloaded, than datasets of all other disciplines combined. This is an indicator that DANS is used more often in the archaeological discipline than in other scientific sectors. The difference in archaeology between 2017 and 2018 is a small decrease of 3,4%, but for other disciplines there is an increase of 16%.

This could indicate that the use of DANS within archaeology is already established practice in research. This can however not be said without a more thorough analysis. The discrepancy between archaeology and other scientific disciplines is evident. This difference could stem from the fact that archaeology is the only scientific field in which it is obligated to store all research data. It could however also be illustrating the fact that archaeological data is primarily stored at DANS, while for other disciplines scientific data are more scattered over different repositories.

Figure 6 shows the number of files that are downloaded for archaeology, compared to all other disciplines put together. This graph is a closer comparison, yet it is telling that the files downloaded for the one discipline still trumps all other file downloads taken together. These graphs combined are a strong indicator that the use of DANS as a research resource is deeply embedded within the archaeological sector. When looking at the overall use of DANS, it becomes very clear that most download events consists of archaeological data.

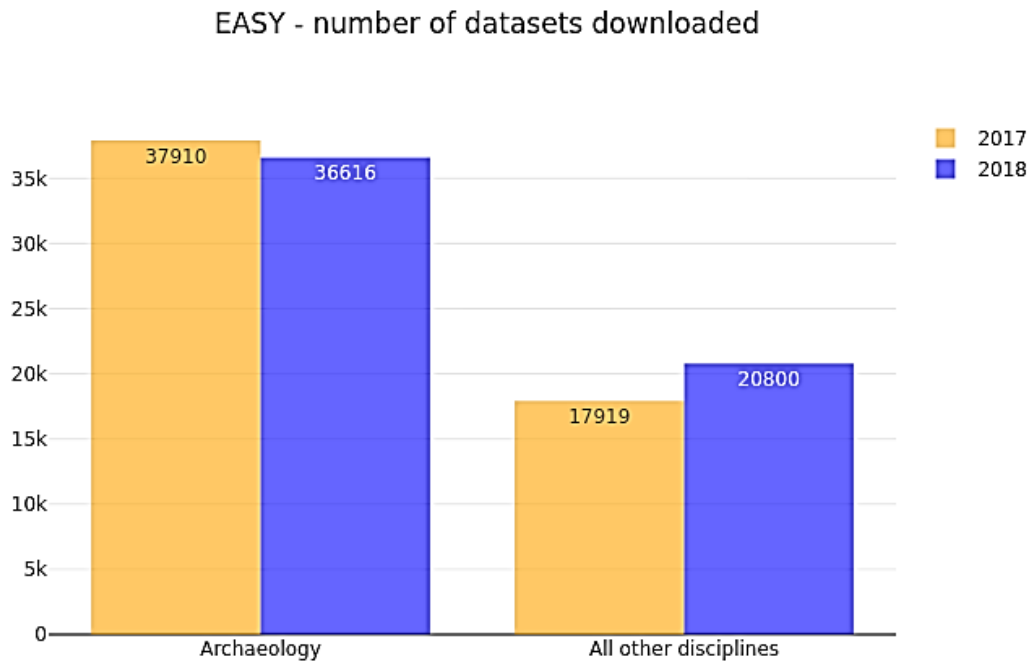

Figure 5 Download events comparing archaeology with all other disciplines at DANS, graph created by DANS for this study

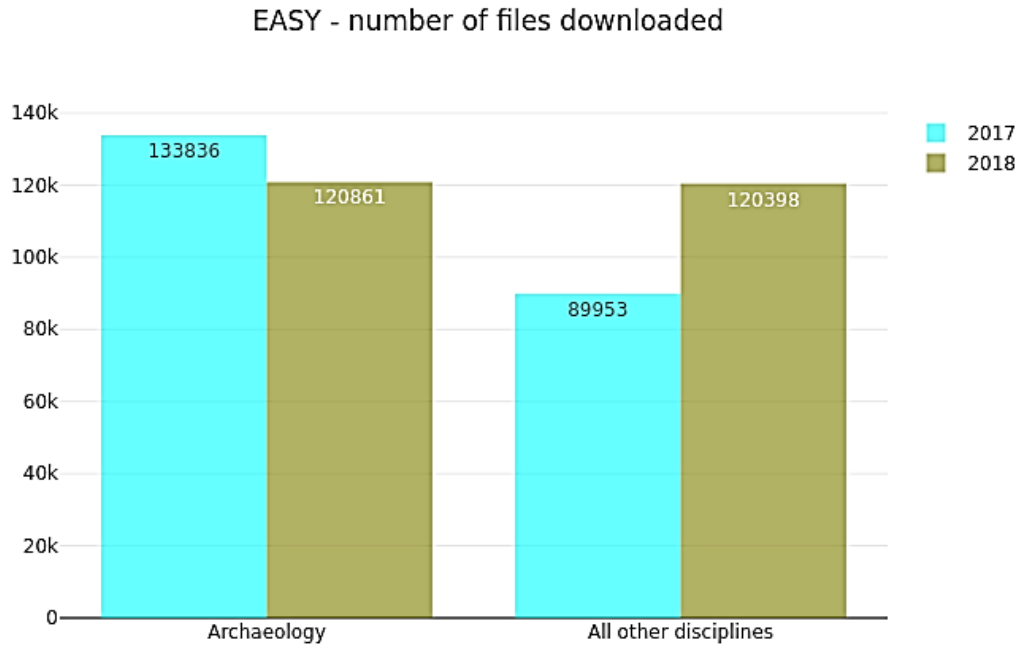

Figure 6 Files downloaded comparing archaeology with all other disciplines at DANS, graph created by DANS for this study

Table 1 Overview of downloads in total numbers and percentage of the whole

	Datasets	Files	% datasets	% files
2017: total	**55829**	**223789**	**100%**	**100%**
Archaeology	37910	133836	67.9%	59.8%
Other disciplines	17919	89953	32.1%	40.2%
2018: total	**57416**	**241259**	**100%**	**100%**
Archaeology	36616	120861	63.8%	50.1%
Other disciplines	20800	120398	36.2%	49.9%

Table 1 shows that of the files downloaded in 2017. 59.8% of the total downloads, and in 2018 50.1% of the downloads contained archaeological files. In 2017 the average files downloaded per dataset was 3.5 while in 2018 the average was 3.3. For the other disciplines the average was 5.0 and 5.8 respectively. These averages have also been calculated per discipline. This is visually represented in figure 7.

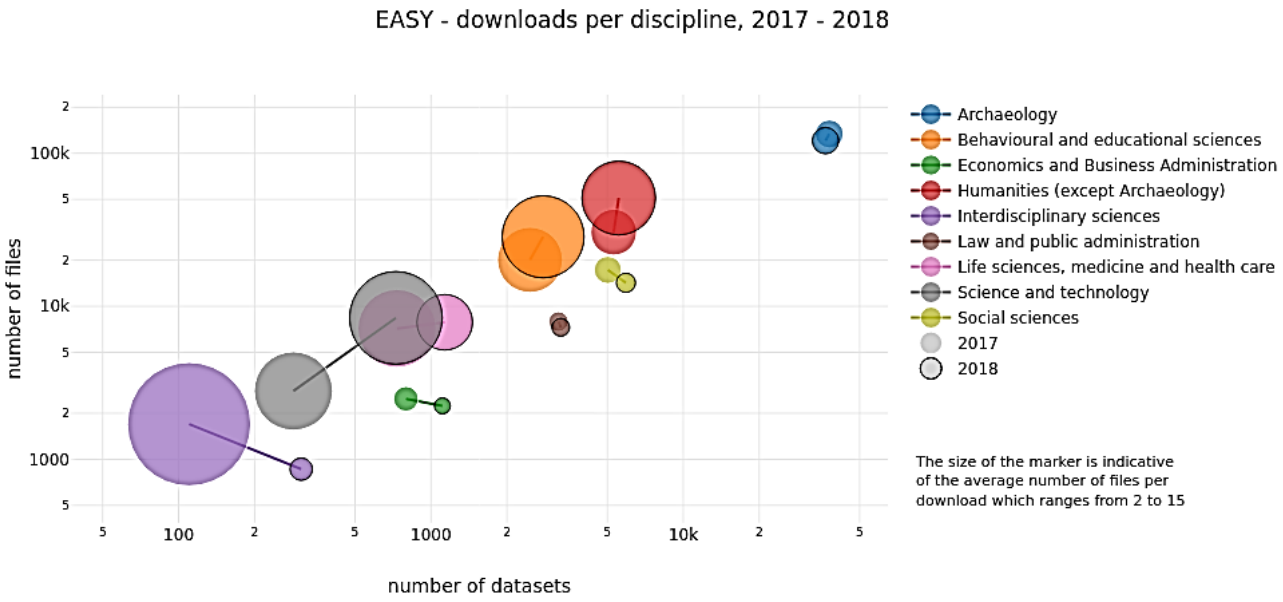

Figure 7 Downloads per discipline in 2017 and 2018, graph created by DANS for this study

This graph shows all different disciplines, with on the x-axis the number of dataset download events, and on the y-axis showing the number of files downloaded. It is important to notice that the axes are in a logarithmic scale, this means that a migration sideways or upwards can have great significance. The size of the circle represents the

average number of files that is downloaded per download. The circle without the black outline represents the year 2017, the circle with the black outline the year 2018. This aligns with the previously noted average datafiles per download, in which archaeology has less files per download than the other disciplines. It shows that archaeology has a high number of downloads and remains constant. For other disciplines there is more fluctuation. With Science and technology as the most noticeable increase of downloads in 2018, nearly 3 times more datasets and files downloaded than in 2017, this can be attributed to a collaboration with the Dutch Techcentre for Life Science (www.dans.knawl.nl) in which DANS attempted to include more beta sciences.

4.5 Archaeological downloads

Other information to research is to establish by which people all these datasets and files are downloaded. For it has become clear that there are many download events within the specialty of archaeology. It would be more interesting to know which part of the downloads is done by professional archaeologists and which part by other interested parties. To this end the account data were combined with the statistics logs in figure 8.

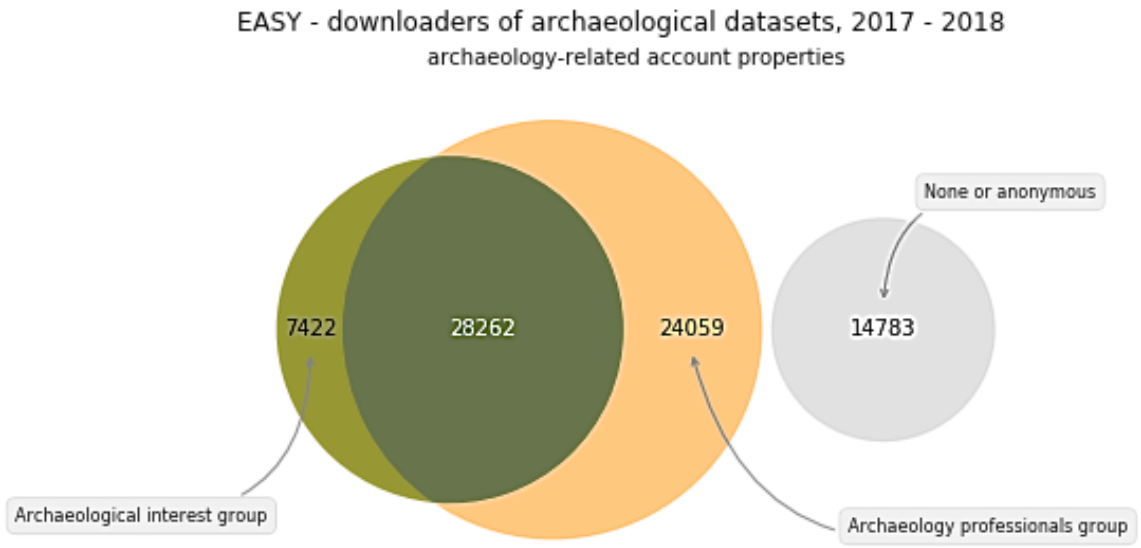

Figure 8 Downloads of archaeology divided by account groups, graph created by DANS for this study

This figure shows that the bulk of archaeological downloads comes from the archaeological professional group and accounts for 70 percent of the downloads. It is important to note that this does not represent the number of accounts in each group, but the times that datasets were downloaded, divided by which group they fall under. For the accounts that have named archaeology as an interest but are not in the

professional group, the number of downloads makes up 10 percent of the downloads. What is more surprising however, is the fact that there is also a substantial group of downloaders who either have an account with no preferences or access to the archaeological professional group, or have downloaded archaeological files without an account, which would have to mean they utilize CC zero open access records. This accounts for 19.8% of the total archaeological downloads. It might be interesting to study this group of users in a more extensive user study to explore who these users are and why they collect archaeological data.

The reason that this group is of consequence, is because it illustrates that the 17% existing accounts that we can pinpoint as being interested in archaeology, see figure 2, is not solely responsible for all archaeological downloads. For it would seem unbalanced if only 17% of the user accounts create more than half of all downloads within DANS. The 70% of downloads coming from the professional group shows that DANS is an important part of the archaeological research process. In the years 2017 and 2018 over 52,000 download events took place from the archaeological professionals. The number of research notifications registered at the RCE for both years comes to 4225 in 2017, and 5025 in 2018 (www.erfgoedmonitor.nl).

An aspect of archaeological downloads not yes discussed is which specific datasets are downloaded. To find out what datasets were downloaded most frequently, a top 10 was assembled from all data in the statistic logs, see figure 9.

rank	doi	title	n_downloads	n_users
1	10.17026/dans-x7g-sjtw	Digitaal Basisbestand Paleogeografie van de Rijn-Maas Delta	3401	584
2	10.17026/dans-xz8-btyd	De steentijd van Nederland	906	555
3	10.17026/dans-25g-gez3	Anthropogenic land-use estimates for the Holocene; HYDE 3.2	2752	242
4	10.17026/dans-zbt-xcck	Archeologische verwachtingskaart uiterwaarden rivierengebied	1368	201
5	10.17026/dans-2a4-trw4	Landscape reconstruction of the western part of the Limes-zone in the Netherlands	697	144
6	10.17026/dans-xf6-ywnd	Archeologische Landschappenkaart van Nederland	445	140
7	10.17026/dans-xky-fsk5	Grondsoortenkaart 2006 - Simplified Soil Map of the Netherlands	279	132
8	10.17026/dans-x84-msac	Venlo Maasboulevard	536	122
9	10.17026/dans-zcj-vzdd	Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek, Volume 23	257	120
10	10.17026/dans-x8d-qmae	Wijk bij Duurstede Veilingterrein DO Opgraving	466	116

Figure 9 Top 10 of archaeological dataset downloads from the period 2011-2019, graph created by DANS for this study

The logs go back to 2011, so what is shown here is the accumulation of downloads from the past 8 years. The top 10 is ranked on the number of unique users that downloaded the whole dataset, or part of it. The downloads represent any time a file has been

downloaded from the dataset. The number of users represent unique users, for users without an account, this was done by looking at the IP address. Within the top 10 of most used datasets are the ones that contain geological maps and archaeological prospection maps. This would point to the start of an archaeological investigation, giving the researcher a preliminary idea of the geological and archaeological context.

4.6 Depositor data

From the downloaded data it has become clear that archaeological data is downloaded on a regular basis. It should also be observed how many users contribute new data to be archived within EASY. This is an important part of the archiving process and might be compared to other user data. The data deposits were divided per unique account, in order to see how many accounts contribute new datasets. First the number of depositions had to be specified, this was split in number of datasets and number of files for the years 2017 and 2018, which is shown in figures 10 and 11.

In figure 10 it becomes apparent that there was an increase in the depositing of datasets in 2018 compared to 2017 for all disciplines. While archaeology is again the largest player in the field with 5185 uploads in 2017 and over 6917 in 2018. It should be noted that the life sciences, medicine and health care discipline are also large depositors with nearly 5000 depositions a year. This stems from the collaboration that DANS started with the Dutch Techcentre for life Science (www.dans.knaw.nl).

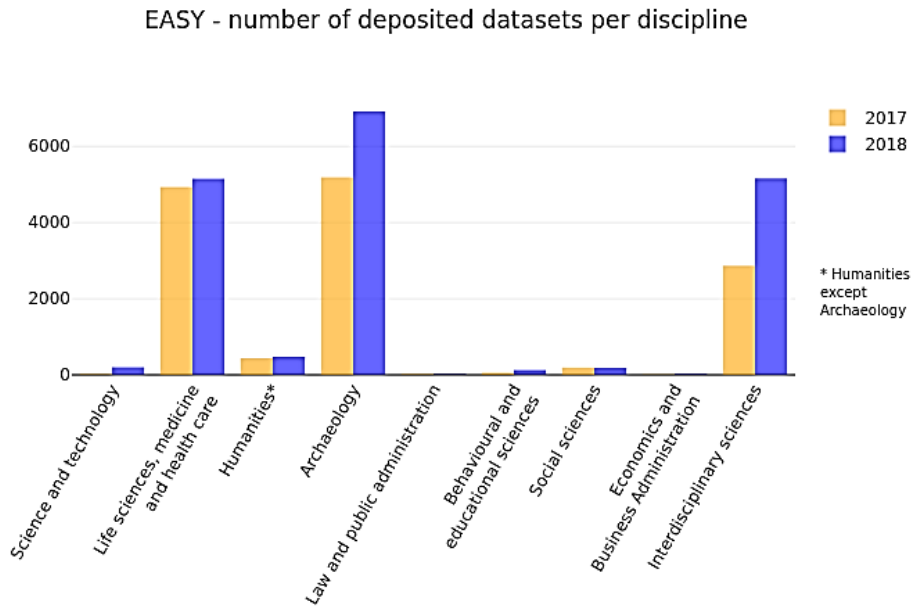

Figure 10 Number of deposited datasets per discipline, graph created by DANS for this study

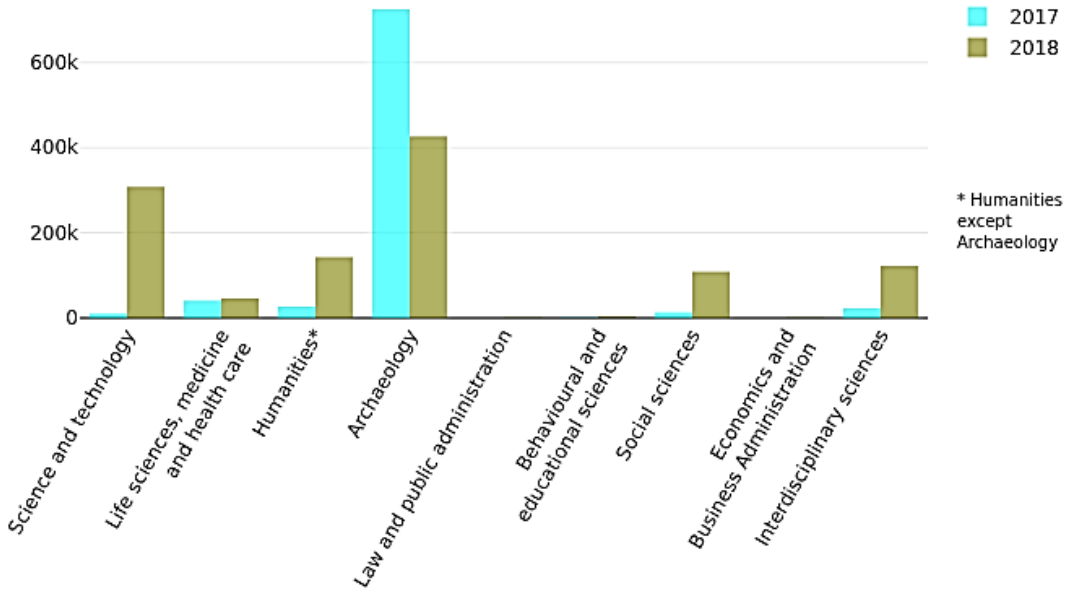

Figure 11 Number of deposited files per discipline, graph created by DANS for this study

Another growing depositor is shown in the Interdisciplinary sciences field. This is difficult one to interpret, for when looking at the download data, it is seemingly non-existent. Also, it is not apparent what interdisciplinary sciences comprises of. This is because the whole discipline consists of archived datasets from another data repository, namely Mendeley of Elsevier. Mendeley is a private repository and requires payment for their data storage and use, they store data from all kinds of scientific research. Mendeley has stored its datasets automatically as a back-up of their own system at DANS EASY and their data can only be accessed through Mendeley itself. Because of this there is no download data of this discipline field, despite of a lot of deposition activity. The subject of interdisciplinary sciences will not be reviewed further during in this examination of DANS.

Figure 11 shows the number of files deposited within DANS in the years 2017 and 2018. Comparing figure 11 to figure 10 it should be noted that the y-axis progresses in hundreds of thousands, instead of the thousands in figure 10. This shows that in the discipline of archaeology in 2017 there have been 650,000 files uploaded into 5000 datasets. For 2018 these numbers are slightly lower with the deposition of 400,000 files in 6000 datasets. To see the contribution of archaeological data in comparison with other disciplines the following figures 12, 13 and table 2 were comprised.

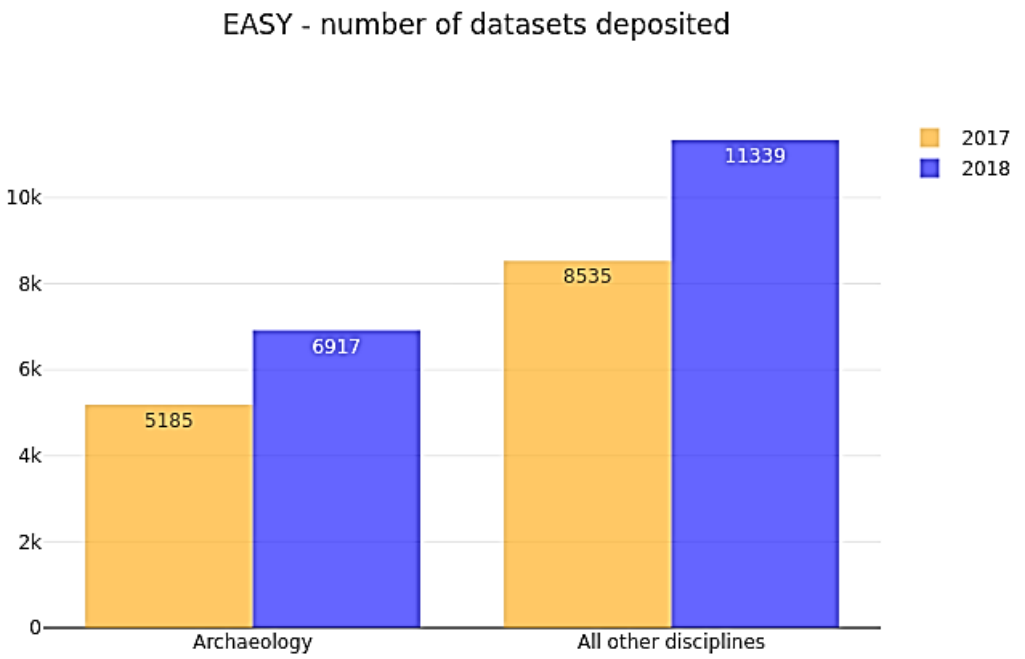

Figure 12 Number of datasets deposited in archaeology compared to all other disciplines combined, graph cretaed by DANS for this study

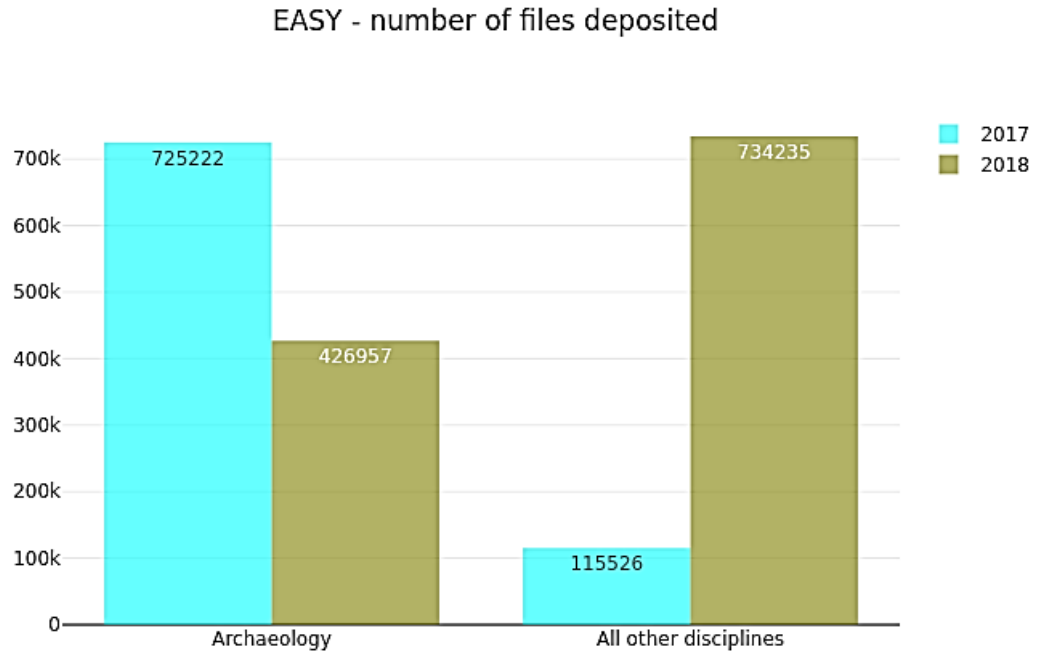

Figure 13 Number of files deposited in archaeology compared to all other disciplines combined, graph created by DANS for this study

When looking at the deposition of datasets, we see a different picture compared to the downloads of datasets. Figure 12 shows that archaeology has a smaller stake in the depositions of datasets DANS wide. In both years archaeology only comprised of one third of all uploaded datasets within DANS. For the one discipline within many, this remains of course a large section. It shows that a third of all dataset deposits are archaeological research.

Table 2 Overview of deposits in total numbers and percentage of the whole over 2017 and 2018

	Datasets	Files	% datasets	% files
2017: total	13,720	840,748	100%	100%
Archaeology	5185	725,222	37.8%	86.3%
Other disciplines	8535	115,526	62,2%	13.7%
2018: total	18,256	1,161,202	100%	100%
Archaeology	6917	426,957	37.9%	36.8%
Other disciplines	11,339	734,235	62.1%	63.2%

Figure 13 is difficult to interpret, for in 2018, the files uploaded by other disciplines has multiplied times 6, in comparison with 2017. The files in the archaeological discipline has decreased from 725 to a 427 thousand, showing a 41% dip. For the file average per dataset it shows 139 files in 2017, and 61 files in 2018, which shows a 56% dip. While these increases and decreases are not indicative of an ongoing trend, for the sample size of two years is far too small, it does show some strong fluctuations in the depositing of data, for archaeology as well as for other disciplines. For archaeology this might stem from the varying number of archaeological studies and excavations in the previous years. When looking at a larger sample size, we can see the accumulative datasets from all disciplines from 2008 until 2018 in figure 14. This image shows that the contribution of datasets was steady in the years 2008-2014 and showed linear growth. From 2014 on however, the graph shows exponential growth, with the largest contributor being the Life sciences, medicine and health care, and the second being archaeology. When looking it figure 14 it would rather seem to contradict the dip from figures 12 and 13, seen in depositions of archaeological data.

The growth of depositions of other scientific disciplines is of interest for the archaeological sector, because in the future it will no longer be the dominant research sector stored at DANS. As primary depositor, archaeology could influence decisions

made by DANS. An example is the map-based search function, this was requested by archaeologists and because it was the largest group to cater to, the request was granted by DANS. When losing the dominant position within DANS, such adaptations in the system specifically meant for archaeology will no longer be an option.

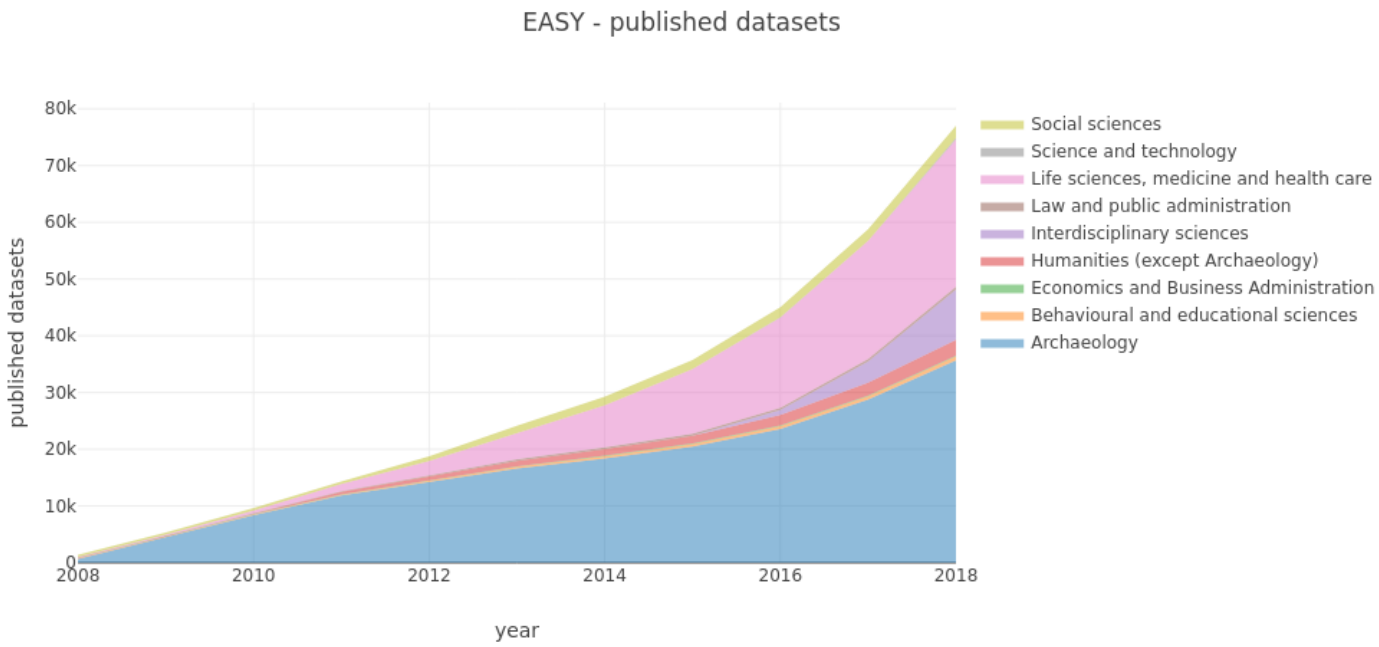

Figure 14 The accumulative published datasets separated by discipline, graph created by DANS for this study

Another interesting fact to come out of this research is the fact that the 40,000 archaeological datasets were mostly deposited by regular users. That is excluding the 13,000 datasets that have been filed by DANS archivists. The remaining 27,000 datasets have been deposited by 420 users during the existence of DANS, showing an average of 64 datasets filed per user. While we have established that the current accounts that were certainly interested in archaeology consist of 3075 users. This means that 13% of all archaeological accounts are depositors. When comparing this number to the number of archaeologists that are employed in governmental, semi-governmental and private companies, which was set at 519 in the year 2013 (Van Londen *et al.* 2014, 65), it raises the question how it is possible that there are over 3.000 user accounts. In this report 97 organisations were identified, meaning that it is not the case that any organisation has 1 employee handling all the data uploading. To better understand how these accounts are being used, further analysis of the users and their behaviour is needed.

The depositors being a small part of the total amount of accounts can also be an indicator that the archaeological data is being reused for further research. Many

accounts make use of several datasets by downloading it for their own research purposes, while only a few accounts add new data.

4.7 Conclusion

This chapter consisted of analysing use and user data of the DANS account database and statistic logs to assess whether DANS is a satisfactory tool in the spreading and disseminating of archaeological data. To answer the question: To what extent is the archaeological data stored at DANS being reused? When looking at the accounts it became clear that a minimum of 17% of the user accounts at DANS are interested in archaeology. From subsequent research into downloader data it became evident that not only users from this group download archaeological data, but that accounts without any preferences or anonymous users also download archaeological content. When looking at the users of DANS it becomes clear that a significant amount of the users searches specifically for archaeological data.

With the use of the statistic logs it was possible to look at the number of downloads and deposits in the years 2017 and 2018. What has become clear from the data analysis is that the archaeological data stored at DANS is being reused. The download statistics show a persistent download rate in the archaeological sector. Any download event is seen as an action of reuse of data, for a download action stems from an active search to a specific dataset and then a specific file. Whether the file is used by a professional archaeologist or by an archaeology enthusiast does not matter, it constitutes the spreading and dissemination of archaeological knowledge. The deposition of datasets shows a variation of dataset and file uploads in the last two years which can only be explained by fluctuation in archaeological studies and difference in sizes of excavations, that might account for the differences in file numbers. What however did become clear is that there is only a small group of depositors, usually from the clerical department of archaeological companies. These depositors seldomly download their own deposited files. This means that a download of files by the depositor is a rare occurrence and cannot be used as an explanation for the download rate of archaeological datasets. This means that a download is done by an interested party.

The fact that the data which is assembled during excavations and other archaeological research is being downloaded and viewed again reveals that the data from former research can still produce value today. It is a demonstration that archaeological data and information from past excavations still have significance for further research. The fact

that it does, proves the worth of the policy of article 7 of the Malta Convention. The high numbers of downloading archaeological data by the archaeological professionals group displays how the Malta Convention has been successfully embedded within Dutch archaeological practice. When starting a new project, archaeologists first search for corresponding data in DANS. By completely embracing the ideas of article 7 it becomes possible to include current discoveries in future research. Considering this, it is only a small investment for the advancement of archaeological knowledge. With DANS being accessible for professional and amateur archaeologists, another step in the process would be to actively involve the civic community.

Chapter 5 The implementation of article 7 in other European states

5.1 Introduction

To frame the situation in the Netherlands it is pertinent to compare it to the situation in other corresponding countries. This chapter will aim to answer the question: How is article 7 implemented in other European countries, and what can be learned from them?

A short overview will be given of several European countries and how their data preservation system is set up. When researching how different states have organized the way in which a short summary record should be stored and made available, it became clear that it varies tremendously. Another issue that was encountered when trying to explore these systems was the language barrier, for every system is understandably in the native language, yet there were only a few that also offered information in English. Finally, there are also several states that do not have a trusted repository, or any system for the preserving of archaeological data in place

For a contrasting exercise of data storage systems England was chosen, this because its socio-economic situation is similar to that of the Netherlands, England has adopted a commercial archaeological system, it has the academic tradition of preserving archaeology by record and has a trusted repository with the data seal of approval. As there are variations in policy throughout the United Kingdom, it is sensible to only treat England for this comparison instead of the whole UK. There will be a focus on the differences between England and the Netherlands in this study. The primary reason to make the comparison with England, is that it is the only other European country with an extensive data storage system for archaeological data.

While the Dutch state has a relatively big government involvement in all layers of administration, England has a very liberal tradition with a small government involvement. This is also clear in the way archaeology is organized in England, as well in the case for the implementation of article 7.

5.2 Overview of other European countries

In 2013 a survey was held under European state members to determine their perspective on the Malta Convention and its national implementations. The surveys were filled out by state heritage representatives, with 34 respondents total, in the responses 15 states indicated to have adopted new measures to implement provisions of the Convention (Olivier and Van Lindt 2014, 167). Concerning article 7 the outcome was that there were no problems encountered during its implications. It has been marked equally successful and unsuccessful, that it has had no significant achievements from its implementation and does not need further provisions to be fully implemented (Olivier and Van Lindt 2014, 168-70). This indistinct responses to article 7 can point to a lacking interest in the subject when implementing the Convention, or to an obscure policy concerning the compliance with article 7.

To see how this is handled in different states this section will give a short overview of the following European countries and their archaeological data management systems; Sweden, Denmark, Belgium and Germany. France and Italy will not be discussed here on account of the language barrier, as little information and articles about their national systems are available in English. It will describe the way article 7 has been executed and how accessible their system is to outsiders that are not familiar with that system.

5.2.1 Sweden

In Sweden archaeology is part of a commercial system with archaeological companies. Archaeological information is gathered and managed at the Riksantikvarieämbetet (Johansen and Mogren 2014, 144) (Swedish National Heritage Board; www.raa.se). The archaeological reports without further research data, are stored in the Förnsok system, which roughly translates to Ancient Search. This system has two levels of access, the public access for any interest parties, and the professional level, which requires a verified user account. Förnsok is entirely in Swedish, and as such is inaccessible for many foreign researchers. For even with accomplished translation software, archaeology contains many very specific terms that cannot all be deciphered by these software programmes. The digital field data is not stored at any digital archive, but are kept by the contractors, such as archeological companies or museums (Larsson 2017). This data can easily get lost when for example a company goes out of business.

Sweden also has a trusted digital repository, the Swedish National Data Service. This repository is very accessible as the entire website can be viewed in English. However, it

does not contain many archaeological datasets. When searching for archaeological data, it gives a total of 470 results. While accessible, this repository has little value as it has limited research resources.

5.2.2 Denmark

While Denmark has embraced the disturber pays within archaeological practice in 2001, it has not made archaeology a free-market endeavor. Denmark has divided itself into several territories in which local museums are responsible for archaeology in their specific area (Lyne 2013, 36; Mikkelsen 2012, 118). These archaeological museums, two universities, the national heritage agency and the National museum are the only parties which may perform excavations in Denmark. After excavations, the site needs to be recorded with a short scientific abstract, in the national database *Fund og Fortidsminder*, which translates to 'finds and ancient monuments' at the national heritage agency website (www.kulturarv.dk). Here the issue is that it does not provide full information on excavations and other research. It is simply a georeferenced database which shows a timeline of archaeological research at a location and the time period it is dated to. This means that a researcher interested in the data can find whether there has been an excavation and by who it was performed. Then any further information needs to be requested from the party that has performed the excavation. This system makes it very laborious for researchers to gain access to information from previously performed excavations. Also, as was the case with the Swedish system, the whole catalogue is only available in Danish, making it difficult for foreign researchers to gain information from the *Fund og Fortidsminder*.

5.2.3 Belgium

Belgium has made archaeology a commercial undertaking with commercial archeological companies which are hired and paid by construction companies. The implementation of article 7 of the Malta Convention is done by complying archaeologist to write a final report on all archaeological research which needs to be stored, physically and digitally, at the regional agency. Belgium is divided into the Flemish region, the Brussels-capital region and the Walloon Region. This also means that there are three different agencies at which the archaeological reports are stored in three different systems (Wouters 2012, 24; www.onroerenderfgoed.be). The three agencies are *Agentschap Onroerend Erfgoed, Agence Wallone du Patrimoine* and Directie van het

Cultureel Erfgoed/*Direction du Patrimoine Culturel* (www.erfgoed.brussel; www.agencewallonnedupatrimoine.be). While these agencies do provide a digital archive of the final reports of archaeological excavations, the archives are only accessible in the native language of the region. This means that in Flanders all reports and metadata is in Dutch, while the archives of the Walloon are entirely in French and Brussels-capital is in both languages. This division of storage of archaeological reports within one state does not make researching archaeological data from excavations very simple. The digital field data such as georeferenced find databases are not kept in the regional archives. Only the information that is incorporated in the final report is thus accessible. When this is taken into account it can be seen as very challenging for researchers to gain enough useful data from former archaeological research in Belgium, especially when one is not fluent in either Dutch or French.

5.2.4 Germany

Germany also has a commercial archaeological system. The agencies responsible for archaeological data storage and research standards are the *Denkmalpflegeämter für Bodendenkmalpflege* or Monument offices (Otten 2012, 101). Germany is divided into Länder which can implement legislation how they choose, meaning that all Länder can execute state legislation in their own way. Some Länder including the writing of a summary report on the excavation in the cost estimate for the construction companies, and others excluding this in the assessment (Otten 2012, 104). This system of free implementation in each Land makes the archaeological sector very scattered throughout Germany. The differences between Länder in Germany concerning archaeology makes it a difficult system. With all monument offices only rendering information in German, this accumulates to a very impenetrable system for foreign archaeologists to conduct research.

To overcome this issue a project was set up to store all archaeological research data in one digital repository, the portal IANUS – Forschungsdatenzentrum Archäologie and Altertumswissenschaften (Research Datacenter Archaeology and Classical Studies), which took place over the years 2011-2017. This system is also entirely in German and no longer has funding to continue the project. As such the project IANUS is not a functioning digital repository from which data can be gathered easily.

5.3 England before Malta

From the 20th century archaeological finds and their appurtenant records have been stored at museums in England. This made museums the largest compiler of archaeological information throughout England. During the 1960's and 1970s, with the growth of rescue excavations, the number of archaeological finds that needed storage also expanded. The archaeological information that came from archaeological excavations consisted of "*The body of finds, environmental samples, paper, photographic and digital records and other material arising from an excavation, together with any analytical reports*" to "*comprise what has become known as 'the archaeological archive'.*" (Merriman and Swain 1999, 250). From a survey carried out by Merriman under museums in the early 1990s it became clear that not even 10% of the archaeological finds were generally on display, and fewer than 10 requests were received by museums on a yearly basis to examine the archaeological archive (Merriman 1993, 13). This does not show a very good use of all the archaeological data that needs to be preserved for posterity. It rather is exemplary of the still prevailing idea that archiving archaeological data is the final stage of archaeological research.

5.4 Laws and Regulations

When in 1990 the British government created the Planning Policy Guidance 16: Archaeology and Planning, it ended rescue excavations as PPG 16 incorporated archaeology within the spatial planning process. Preceding the Malta Convention, the PPG 16 document already favours keeping archaeological remains *in situ* rather than excavating the site and integrated archaeology in the planning process. The document stated in article 13 that when a site may not be kept *in situ*, the site should be preserved by recording the archaeological information (Department for Communities and Local Government 2006). While the preservation by record is described as a feasible option to retain the archaeological data, no provisions were made to retain the records themselves. It does however state that a record of the important archaeological locations and excavations should be kept at the Sites and Monuments Records (SMR) department, a station that should be present in every county.

In 2001 the Malta Convention was entered into force in the United Kingdom. This did not call for an adaptation of the National Heritage Act. The Malta Convention was considered already part of the Heritage policy.

In 2010 a new policy statement was issued, which replaced the PPG 16. This 'Planning Policy Statement 5: Planning for the historic environment' combines the archaeological heritage with built heritage and aims to preserve these as they are a non-renewable resource. It states that all relevant heritage information should be stored at the Historical Environmental Records (HER), previously known as the Sites and Monuments records (Department for Communities and Local Government 2010). The difference between the HER and the SMR is that the HER specifically developed systems to gain more knowledge of the wider historic environment. Their task is to preserve records concerning monuments, events such as archaeological excavations and the sources and archives (www.historicengland.org.uk). These materials are consequently entered into a GIS system, which are linked to other counties, creating a portal in which archaeological information is stored and can be retrieved. This portal, the Heritage Gateway, contains approximately 60 percent of local HERs records (www.heritagegateway.org.uk).
In February of 2019 the revised National Planning Policy Framework was updated, replacing the former planning policies. In the revised edition, article 188 states that the HERs should have up-to-date evidence about the historic environment in their area and should make this information publicly accessible (Ministry of Housing, Communities and Local Government 2019, 55).

5.5 Commercial system

During the 1980s and 1990s, many European countries privatized large public sectors, such as banks and public transport systems. Following this privatization movement some governments also started to regard preventive archaeology as something which was not the responsibility of the state (Demoule 2012, 617). Thus started the commercialization of the archaeological sector in the United Kingdom. In the capitalist system it is believed that the rules and guidelines are governed by the free market. Here however the dichotomy of the building companies and archaeological sector comes to light, for with the implementation of the disturber pays principle, the construction companies are obligated to foot the bill of all archaeological research. As the free market objective is to make as much profit as possible, any company will primarily look at costs when selecting an archaeological company, and not at quality of the archaeological research. When considering archaeological research and knowledge as national heritage which should be preserved at any cost, archaeology cannot be left solely to capitalist principles in which the main goal is to create revenue, these are conflicting interests. Here the government

should step in to demand minimal standards and guidelines for archaeological research. In England however, this was not done by the state, but was left to the archaeological sector itself. Without any regulation or monitoring, problems with quality control and access to excavation reports from private companies occurred (Kristiansen 2009, 643). This is particularly a problem with the records created by archaeological companies, for those companies also need to gain revenues to survive in a competitive field. Meaning that of the two physical copies of the archaeological reports, one was to be stored at the local HER and one handed to the contractor. The storing of reports in a sustainable way is costly and is something that will quickly be disregarded when it is not compulsory. In the short term this might be a quick fix which will save a company money, yet when regarding this policy in the long term it should become apparent that it negates the efforts undertaken to gain archaeological understanding of the past, rendering the money spent meaningless. By storing information at HERs the summary information from archaeological research is safeguarded, yet only locally visible. With the use of HERs there is no adequate overview on a national level. After the discussion of the worth of grey literature, Bradley discovered that the insufficient quality, so commonly ascribed to commercial excavations reports, did not hold true (Bradley 2006, 11). For his research into prehistoric Britain, he visited several HERs throughout England and is of opinion that the grey literature in consultation with the organizations that had undertaken the fieldwork, can be very valuable as a source. He does admit that it takes time, for one must journey to several HERs and actively engage with the reports and databases. But he rejects the notion that these grey literature reports are not of any academic value. With the writing of this article Bradley shows that archiving of archaeological information is no longer an end station for archaeological information, but that the archive should be an integral part of the research cycle.

5.6 ADS: a trusted repository

In 1996 the Archaeology Data Service was set up as part of a larger humanities project, the Arts and Humanities Data Service. When in 2008 the funding of AHDS was halted, it was decided that funding for the ADS would continue for some years while assisting it in becoming a self-sustaining organization. This was done because archaeological data was considered as consequential because of its destructive methods to obtain such information (Richards 2017, 227). The ADS archive is based on the Open Archival Information System (OAIS) and has received the Data Seal of Approval for digital

repositories (www.coretrustseal.org). The goal of ADS is to create a long-term digital preservation of entered data.

A project by ADS was OASIS (Online AccesS to the Index of archaeological investigationS), a joint undertaking with the National Heritage Agencies of England and Scotland. Its aim was to gather and create an overview of all archaeological grey literature in the United Kingdom. This was realized by making an online data collection form, that gathers keywords and information about any type of archaeological research and makes it possible for the creator to upload their report into the system. By doing this it is uploaded into the HER and the ADS grey literature library. The project started in 2003 and continues until this day. As of April 2019, the Library of Unpublished Fieldwork Reports contains over 50,000 fieldwork reports.

As with DANS, the ADS has a self-archiving function. This means that the creator can make their dataset available on ADS by uploading it in the repository, granted that the data does not exceed 300 files. The ADS has an accepted file format list, to which archaeologists needs to adhere, this can be seen in figure 15.

There are however major differences in the modus operandi of DANS and the ADS. The ADS is a commercial repository, meaning that they have to create revenue to keep the system going. This is accomplished by making data storage a paid service. When uploading a database or multiple datasets, the cost is calculated by the size and types of files. It requires a single payment at deposition, which will guarantee long-term storage at ADS. When the data is solely stored at ADS the download is free, the metadata however is always freely accessible. When stored somewhere else, ADS can link to the page containing the information. The costs for the storage of data is charged to the client of the archaeologists, when this client is a research council or heritage organisation, it often compels the archaeologists to store its findings sustainably at ADS (Aloia *et al.* 2017). This is the second difference between the two repositories, while in the Netherlands it is mandatory to deposit archaeological results in a trusted e-depot, this is not the case for England. The reason behind the fact that England does not make this compulsory may lie in the liberal Anglo-Saxon model. Or may stem from what Bradley describes as (Bradley 2006, 3):

> ***"a still more pervasive feature of British intellectual life: a sceptical attitude to theory, a fear of over-interpretation and a concern for documentation as a valuable aim in itself."***

A somewhat curious view as archaeologists, because precise documentation is considered one of the most important aspect of proper excavations.

GUIDELINES FOR DEPOSITORS

Preferred and Accepted File Formats

Data Type	Preferred File Format	Accepted File Format	Documentation
3D Models, Visualisation, and Virtual Reality	Depositors wishing to deposit 3D models or virtual reality are urged to contact us for information on appropriate formats and metadata.		
Audio	* Broadcast Wave Format (.bwf) * Waveform Audio (.wav)	* Audio Interchange File (.aif) * SUN (.au) * Flac (.flac)	* Software. * Bit depth. * Bit rate (kbps). * Sample rate (kHz). * Codec used. * Length of recording (hh:mm:ss). * Copyright clearances. * Transcriptions of interviews.
CAD and Vector graphics	* AutoCAD (.dwg) (2010 or later) * Scalable Vector Graphics (.svg)	* Drawing Interchange Format (.dxf) * AutoCAD (.dwg) (2010 or earlier)	* see metadata template. * Document all conventions (layers, colours, line types, hatch styles, symbols, etc) * Externally referenced files in suitable deposition format should be included and documented.
Databases	* Comma-separated values (.csv)	* Dbase (.dbf) * Delimited text (.txt) * Microsoft Access (.mdb/.accdb) * Microsoft Excel (.xls/.xlsx) * OpenDocument Database (.odb) * Exchange formats (.json/.xml/.rdf)	* see metadata template. * Document any codes and conventions used. * Databases should be accompanied by an entity relationship diagram.
Geophysics	* Raw xyz data (.txt/.csv) * SEG-Y (.segy)	* Raw contour data (.dat/.rep)	* see metadata template. * A geo-rectified TIF of high quality (with associated documentation, see GIS section) is also requested.
GIS	* ESRI Shapefile (.shp + .shx + .dbf and other associated files) * Geography Markup Language (.gml) **Raster** * Geo-referenced TIF Image (.tif/.tif + .tfw)	* ArcInfo Interchange (.e00) * MapInfo Interchange Format (.mif + .mid) **Raster** * GeoTIFF (.tif + .rrd,.aux,.xml) * ESRI GRID ascii(.asc/.grd) * ESRI GRID binary (.adf) * JPG World (.jpg + .jpw) * PNG World (.png + .pgw) * Keyhole Markup Language (.kml) **Geodatabases** * Delimited text and ESRI Shapefile (.csv + .shp) * GeoJSON (.geojson)	* see metadata template.
Images	* Uncompressed Baseline TIFF v.6 (.tiff/.tif) * Joint Photographic Expert Group (.jpeg/.jpg)	* Portable Network Graphics (.png) * Graphics Interchange Format (.gif) * Bit-Mapped Graphics Format (.bmp) * Adobe Digital Negative (.dng) * JPEG2000 (.jp2/.jpx)	* see metadata template.

Figure 15 First page of ADS preferred file formats, after https://archaeologydataservice.ac.uk/advice/FileFormatTable.xhtml/

The third difference between ADS and DANS is the difference of organization of data. In DANS one typically searches in the metadata and all of the corresponding data is stored and available at DANS itself. While the ADS operate more as a search engine that crosses different facilities of data storage, such as the UK Heritage agencies data. The result consists of data that is held at the ADS and data that is present at another repository. It can even result in showing the metadata of the report, and the information where it can be found physically, when it is not digitally available.

5.7 Conclusion

While other European countries such as Sweden, Denmark, Belgium and Germany have implemented the Malta Convention and have guidelines to create summary records of archaeological excavations, they do not possess sustainable digital repositories that are easily accessible for foreign researchers. It has become clear that the creation of a *scientific summary record* can be interpreted in many ways, which causes significant discrepancies in quality of final reports and accessibility. The digital field data is generally not incorporated within the national data storage system, making that data vulnerable to degeneration. For if the data is not actively managed, it can become inaccessible because servers might crash, files formats deteriorate and can no longer be opened, or the accompanying metadata is no longer available, rendering the data meaningless. As such the data management in these countries is not done in a sustainable way, which might mean the loss of a considerable amount of data. England on the contrary, has a trusted digital repository in place which is comparable to that of the Netherlands. Yet the ADS system in England also has major differences in the execution of gathering archaeological data, which is why these systems will be compared in greater detail.

Over the last 30 years the storage and archiving of archaeological data and reports in England have significantly changed. Previous data storage systems in England consisted of storing artefacts and field data at local museums, later excavation reports were stored at local heritage offices, with accessibility increased over the years.

During the 1990s, archaeology became a commercial enterprise, where an archaeological business had to tender for an excavation contract. Without any official regulations about the quality of work and the documentation, many archaeological reports became part of the mass of unpublished excavation reports that were inaccessible for further research, also known as the grey literature. The storing of the information sustainably was uncommon practice.

For this reason, the ADS was created in 1996. First as part of a larger funded humanities project, later as a self-sustaining digital repository. As with archaeology in England, the ADS is a commercial venture. The ADS is an accredited repository with the Data Seal of Approval, which means it is a long-term sustainable digital archive. With the on-going OASIS project, the ADS has collected 50,000 excavation reports in the Library of Unpublished Fieldwork reports, which can be queried in the ADS portal. The ADS is a portal which searches through different heritage databases, such as the Heritage

agencies and several journals. This means that not all sources are available at the ADS, yet in the result it gives a link or location where the information is stored. When reviewing, the main differences with DANS is that ADS is a commercial institution that charges its users, it is not a mandated place for archaeological data storage, and that it searches through many different digital repositories to find and present data, that it does not store itself.

When looking at the system in England, it becomes clear that while it may seem similar to the situation in the Netherlands, there are also considerable differences. For in the Netherland the commercial system is still regulated by the state, where several issues concerning data management are either implemented into legislation or are applied through quality requirements. In England the responsibility for well-executed archaeology and documentation lies much more with the archaeology sector itself. Despite of the differences in approach, this does not mean that archaeological information in England is not organized well. While it has a more scattered landscape of archaeological data storage, the sustainably keeping of data is something that is considered important. So much even, that with ADS it has a successful commercial archaeological repository. From the ADS it can be learned that it is also possible for archaeological data to be stored in a commercial trusted digital repository. However, it should be recognized that the ADS does not have control over all datasets and reports, because it does not collect all data that they manage in their internal system. When data is stored externally, it remains an uncertainty, for if that website ceases to exists, it is lost to everyone. This is what makes DANS a more secure storing facility for permanently storing archaeological data.

Chapter 6 The international aspect of Malta

6.1 Introduction

In questioning the success of collecting and disseminating of scientific information one cannot surpass the international aspect of the Malta Convention. Article 8 of the Convention states that all parties should ensure international cooperation on archaeological heritage and knowledge exchange between countries. This leads to the question: Is the archaeological data made accessible in an international perspective and why is this important? This ambition is very difficult when information exchange within European countries happens mainly in their own language. When looking at the Dutch system of archaeological management it becomes clear that nearly all data that is gathered, is recorded in Dutch. One can only wonder how all that information can ever be made accessible for foreign researchers. Having examined the ways in which the Dutch state has endeavoured to make all archaeological research accessible and reusable to current and future generations, this chapter will explore how archaeological data is made internationally accessible and why this is done.

6.2 International data projects

While cultural international cooperation is a goal of the Ministry of Education, Culture and Science (Rijksdienst voor het Cultureel Erfgoed 2016, 5), article 8 has not been implemented into heritage legislation of the Netherlands. Instead of through national legislation, archaeological European heritage projects are realised through obtaining subsidies from the European Union. Principle requirements for the funding of these projects are cooperation and integration between the participating parties (Aspöck and Geser 2014, 2). Some of the projects from the last years are: CARARE, ARIADNE, and PARTHENOS, in these projects DANS was a partner. All these projects dealt with sharing archaeology or cultural heritage through an internet platform. The CARARE project was to make 2 million archaeological and architectural features accessible with the web platform Europeana (www.carare.eu). The ARIADNE project was designed to connect archaeological databases and make all archaeological information searchable in the ARIADNE portal (www.ariadne-infrastructure.eu). The PARTHENOS project aims to harmonize and improve existing e-heritage infrastructures for the humanities (www.parthenos-project.eu). For this study, we will look at the ARIADNE programme. This because PARTHENOS, while also dealing with connecting data infrastructures for

humanities, is a broader humanities project, Europeana is a platform for objects and artefacts, while ARIADNE is specifically aimed at sharing of archaeological excavation data.

These international projects are relevant in the modern globalising world, for accessible open data has become the norm in scientific research. Especially in archaeology researchers accept that national borders as they are now, might have shifted many times in the past. To study cultures which can span many centuries and geographic areas, it is important to realize that national data of these societies cannot be relied on. To gain access to a broader set of data, an efficient communication and data storage system needs to be put in place (Kansa 2011, 6).

6.3 ARIADNE

ARIADNE stands for Advanced Research Infrastructure for Archaeological Dataset Networking in Europe and was a project that took place in the years 2013-2016.

6.3.1 The beginning

ARIADNE was designed to connect all European digital archaeological archives, and to overcome the fragmentation of digital archaeological data (Aspöck and Geser 2014, 7). This meant that parties with an existing digital archaeological repository, or standardized collection could participate in the project. The final product was a portal, a search engine for archaeological research data, while not moving the actual datasets. This e-infrastructure will be a tool to connect all archaeological data in digital repositories across Europe, to advance the reuse of data in the archaeological community. Many archaeological researchers expressed the need to find all collected datasets in one location. In a user survey executed by ARIADNE in 2014 of the 591 respondents, 87% agreed with the statement "*We often do not know what is available, because research data are stored in so many different places and databases (and languages).".* Another 61% agreed with the assertion that it is "*difficult to get access to relevant literature and data because they are kept in private collections of other researchers*." (Geser and Selhofer 2014, 90).

At the end of the project, ARIADNE gathered over 1,700,000 datasets. There were 23 partners in the project from 16 different European countries (Wright and Richards 2018, S63), among them from the Netherlands, DANS and VU Amsterdam. The portal was meant to search for things like *bronze age farm* and get results from all over Europe in which this term was used in its description. Only partners of the undertaking granted

(sometimes limited) access to their archaeological datasets. Every partner then had to make a translation for archaeological terms, specify what time period and/or cultures their country had, and reference their own spatial recording system into another coordinate system. This was one of the hardest, yet most essential thing to do, for the portal would be only able to search in the metadata, so the metadata all had to be embedded into one system. The final product needed to be searchable by text, time period and location.

6.3.2 Connecting different languages

The portal was designed to only search in the descriptions of the archaeological datasets, so only the metadata had to be adapted into one coherent system. This does of course mean that a researcher from Sweden would be able to find the research done in the Netherlands on a bronze age farm, yet they would not be able to read the actual report, which would remain in its original place, in the original Dutch language. To be even able to find this data from another country was already going to be an extensive business, so this is where the first steps were taken. For the translation of metadata terms every partner had to collect all their standardized metadata terms from their database. These metadata terms would have to be examined by an archaeologist, sometimes even specialists in a specific field, and then had to be translated into a term from the Getty Art and Architecture Thesaurus. While the first step was already done by a computer programme for most participants, (DANS did the translation manually), the terms and their given translation had to be checked by someone with archaeological expertise (Aloia *et al.* 2017). In the case of the DANS system, this was relatively easy, as it meant translating one thesaurus into another. This is because in Dutch archaeology already had an ABR thesaurus in common use (Archeologisch Basis Register). While this conversion of thesauri was done partly by machine recognition, it did remain a human executed endeavour. Every term had to be checked by an archaeologist, for while a term can have a perfect translation according to the dictionary, semantics should also be considered. For a term which is essentially the same in different languages can have different semantic connotations in other countries. This is why achieving semantic interoperability is such a complex undertaking. For this reason, the linking of different thesauri was transferred into ontologies, such as CIDOC-CRM (Aloia *et al.* 2017), which include rules and strict definitions of meaning.

6.3.3 Connecting different timescales

Another difficulty in connecting archaeological data from different countries is the difference in time periods and cultures. In Greece for example, the Bronze Age started at 3200 BC, while in the Netherlands the Bronze age is dated to start around 2000 BC. This has to do with the geographical location of these countries, and the spreading of culture in a non-globalized world. Where Greece was near the origins of the Bronze Age culture in Mesopotamia, the Netherlands is a few thousand kilometres away, located in Northwest Europe. With little interaction between the two areas in that time period, the innovation of bronze smelting did not reach Northwest Europe for another thousand years.

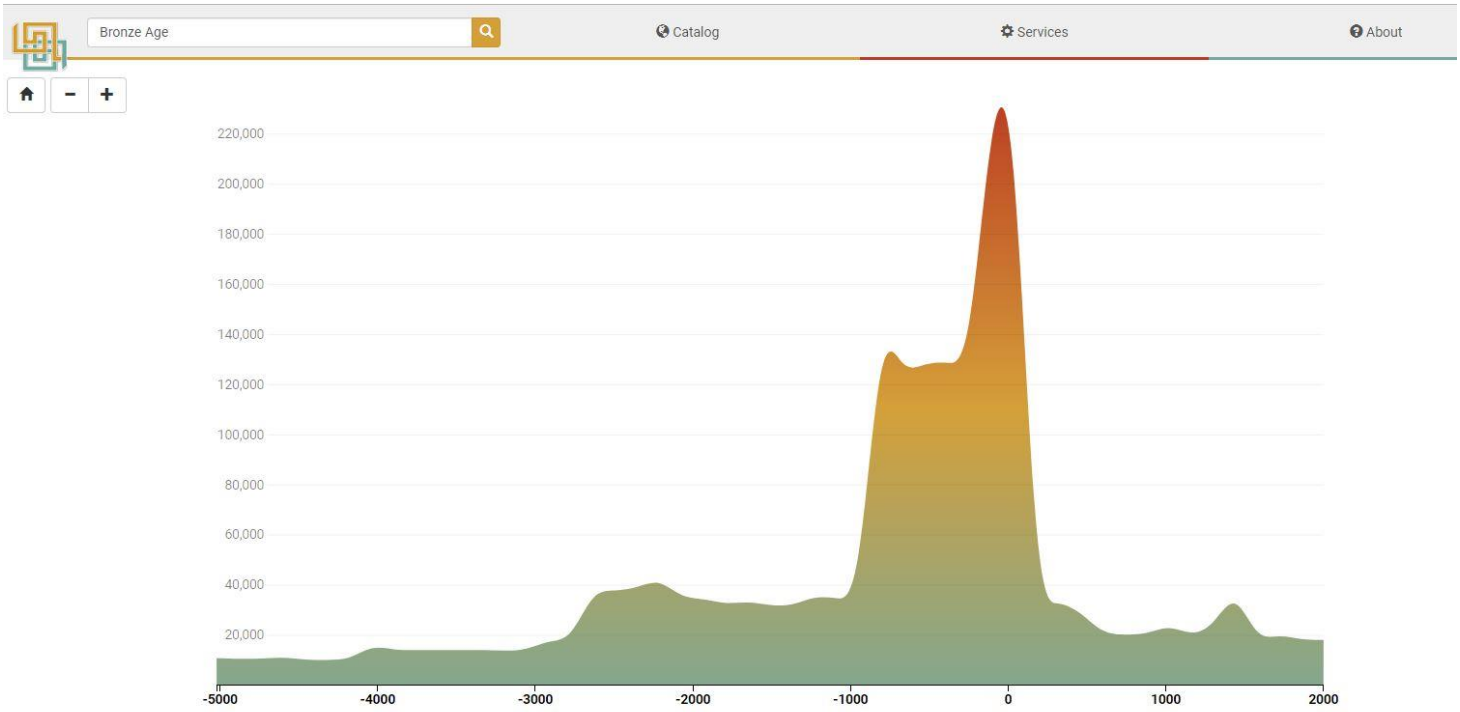

Figure 16 Timeline of the Bronze Age in the Ariadne portal, www.ariadne-infrastructure.eu

This however creates a dichotomy in the dating of specific cultures. When researching the Bronze Age throughout Europe, it would be very inconvenient if the search portal would limit itself to the time period of the northwest bronze age period, excluding many Greek Bronze Age results. However, setting it too broad, like when starting at the Greek Bronze age, the query could include many sites predating the Bronze Age in Northwest Europe. This was done by a mapping of time periods by the various countries. Another feature included in the portal was a timeline of the search results. As can be seen when

entering the query Bronze Age into the portal, the following timeline visualisation appears, see figure 16.
Here we can see that the Bronze Age finds have been observed dating from at least 5000 BC but has its peak in the first millennium BC to decline in number of finds in the from the first century AD.
To include all differing timescales of cultures throughout Europe there needed to be another adaptation performed by the archaeological parties involved in ARIADNE. In this case every party had to precisely date all their existing differing cultures with start and end dates. This was done to create a timeline of the cultures uncovered by archaeology in their country. All this data was entered into a system called Period0 (www.perio.do), which processed the data and is able to visualize all data according to these periods.

6.3.4 Connecting of location

The final way in which ARIADNE was to connect archaeological datasets, was to enter all spatial data into one georeferencing system. This was done because commonly the coordinates of archaeological research are entered into a national coordinate system. In the Netherlands for example all coordinates are in the RD spatial reference system (Rijksdriehoekcoördinaten). These systems are designed to only apply within its national borders and bodies of water, so it was not compatible with an international georeferencing project. The impartial World Geodetic System 1984, designed in the Unites States, was chosen as the joint spatial reference system. This system is commonly used throughout the world and therefore an excellent compromise. Many archaeologists requested the use of a map within the user interface of the portal. This is because it shows the geographical spread of sites and monuments of a specific culture. Yet it is also an important asset when incorporating archaeological information within the spatial planning process. It can also benefit a desk study, when orienting on a specific topographical area to make an inventory of archaeological sites that have been discovered in the past. The map can be used by zooming into a specific area and showing all archaeological occurrences, or by entering a query of a specific item or period, which will narrow the search.

6.3.5 Problems in ARIADNE

While being a project with enormous progress in sharing archaeological data throughout Europe, ARIADNE also had its problems. For all the work that has been put into the portal, in the adaptations into the GAA thesaurus, it cannot change the fact that it remains a classic search engine. This set-up has the disadvantage that it searches for the exact terms that are entered into the query, which prioritises its findings by counting the times the term is mentioned in the actual record. This can be seen by entering the same term in two languages into the portal, which gives different results. Entering the Dutch term *Bronstijd,* the top results are all Dutch datasets concerning excavations in the Netherlands, shown in figure 17. However, when entering the term *Bronze Age,* the top results are datasets from the UK, see figure 18. When taking a closer look at these figures, one can see not only differences in search results, but also a difference in the map, where the Dutch only yields results in the Northwest of Europe, while the English term also shows a geographical spread of the Bronze age in Southern Europe, such as Italy and Greece. The reason behind this difference in search results is simply because of language, the Dutch records mention the term Bronstijd several times in the title and metadata, the English translation of Bronstijd is only mentioned once.

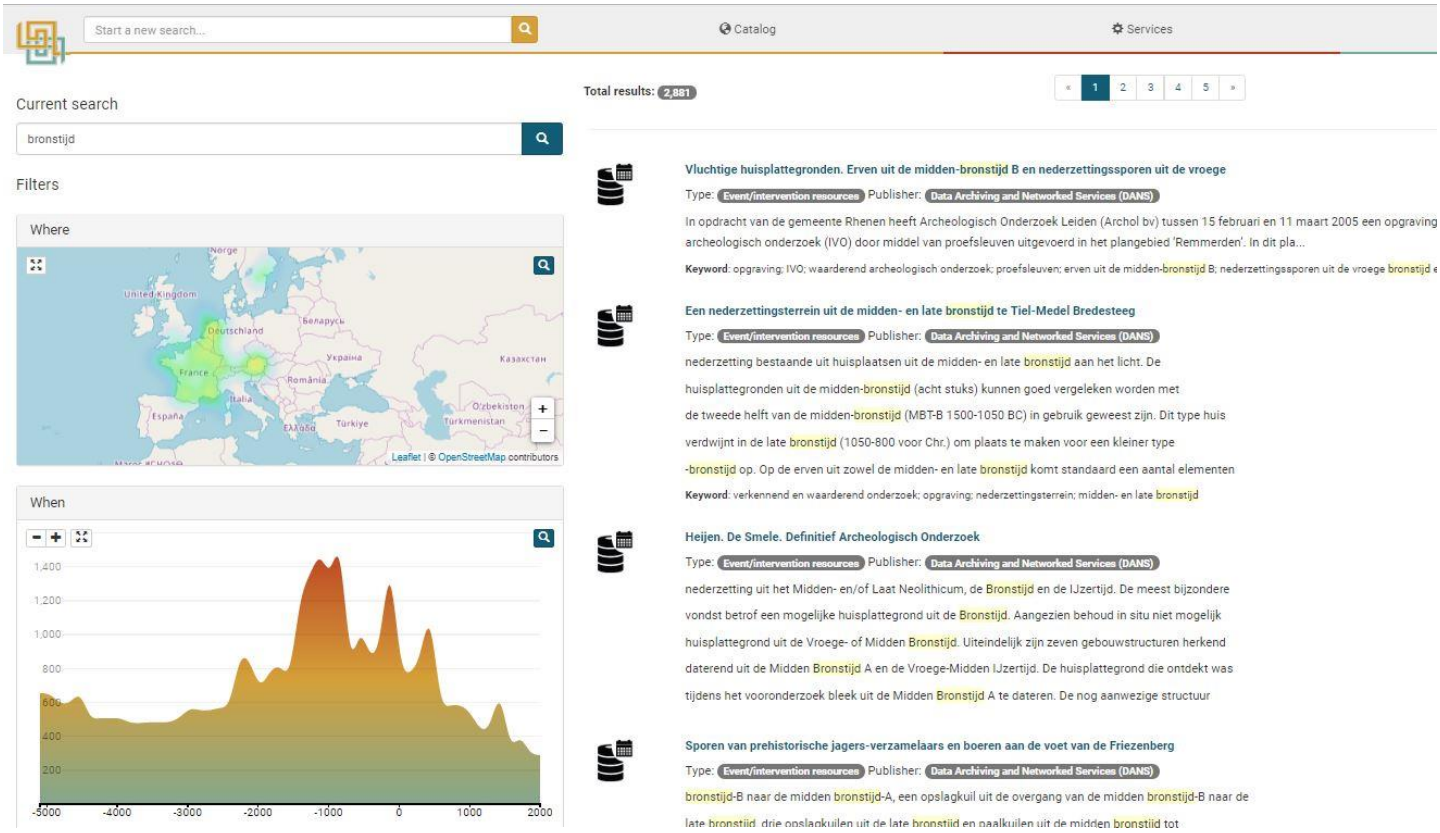

Figure 17 Results of the term 'Bronstijd' in Ariadne-portal, after https://www.ariadne-infrastructure.eu/portal

This is exactly what happens when entering the English terms, these results have Bronze Age in the title of the research, giving it a higher ranking in the sorting process. Following this logic, when searching in your own language, the results from that language will have a higher sorting in the search results. Yet, when entering search terms in English, it is more likely that results from the United Kingdom are given priority. This distorts the search results tremendously, with data from the UK having a higher ranking in every query with English search words.

That there is a difference in the search result can also be seen through reviewing the time scales in both figures. When typing the English term the period seems much more defined, with a clear peak in the first millenium BC. The Dutch term however shows a more divergent picture, with more small peaks in Bronze Age finds. Ideally, both the Ducth and English term should yield the same geographical spread and timeline of the Bronze Age in Europe.

Another issue that will become increasingly important during the next decade, will be the fact that ARIADNE is not yet able to do a deeptext search, which searches not only the metadata, but all text files that are part of the record. It can only find things on the basis of the metadata.

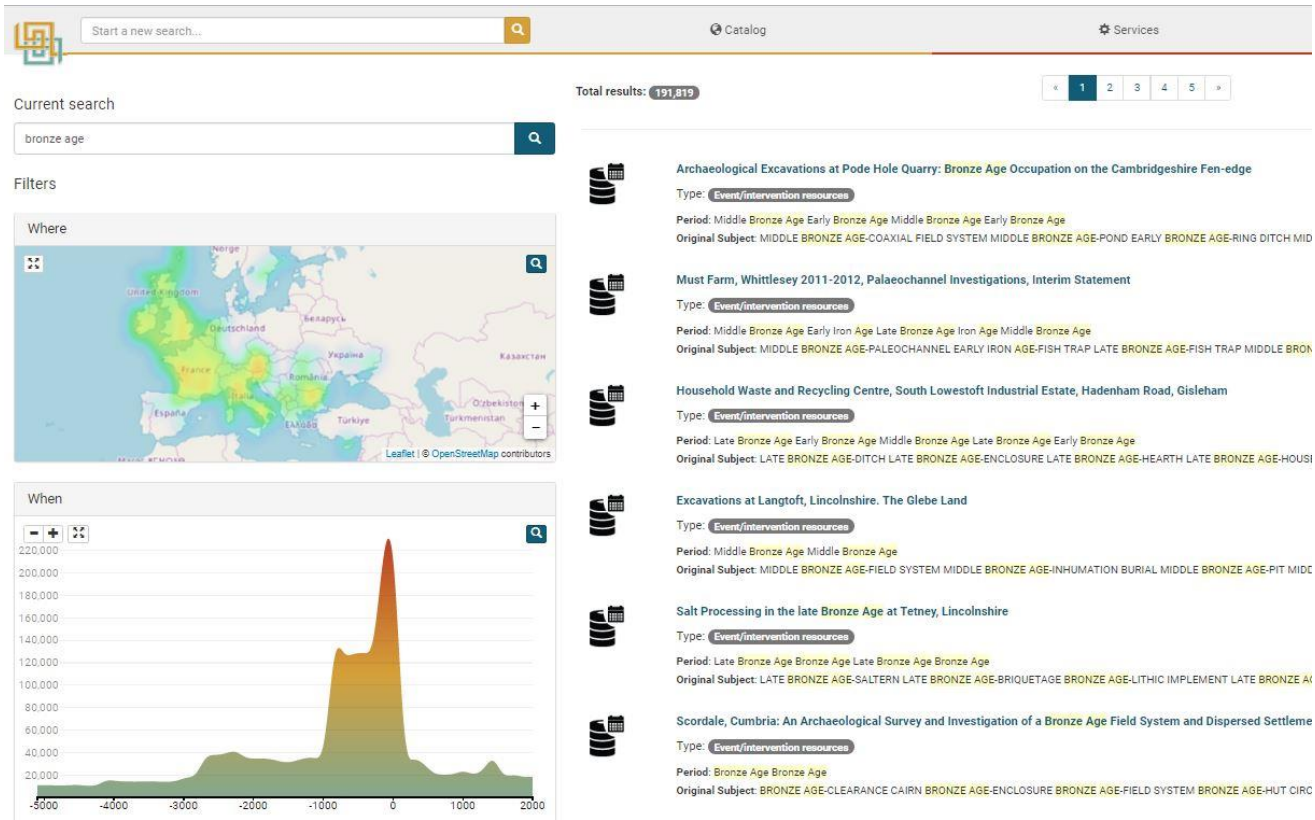

Figure 18 Results of the term 'Bronze Age' in Ariadne-portal, after https://www.ariadne-infrastructure.eu/portal

As mentioned before, deeptext searching is the way forward, for metadata is only a small sample of what is treated in the full-text resources, databases and maps.When only searching though metadata there might be many things that researchers will never be able to find. Even with the introduction of deeptext search, the problem of different languages remains. As such, it must be accepted there cannot be a true interoperability between different states.

6.4 ARIADNEplus

A possible solution to these problems may arise from the continuation of the project with ARIADNEplus, which started in January 2019 and will run for four years. ARIADNEplus is funded by the European Commission under de H2020 Programme. With the resuming of the project, it also has more participants from Europe now adding up to 41 organisations. The difference in participation can be seen in figure 19 (ARIADNEplus 2019, 6), with the left side showing the geographic coverage of ARIADNE and the right-hand side shows the same for ARIADNEplus, the darker the colour, the higher degree of coverage of data integration into the portal. Some of the participants are even from outside of Europe, namely Japan and the United States of America.

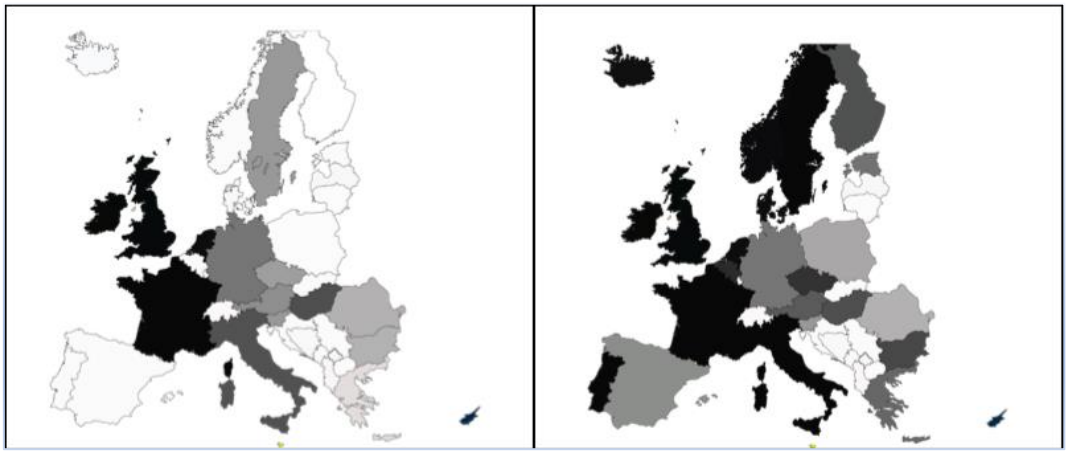

Figure 19 Participation in the ARIADNE project on the left, participtionin the ARIADNEplus project shown on the right, (ARIADNEplus 2019, 6)

The project synopsis describes the goals it has set for this project as “extending and focusing ARIADNE” (www.ariadne-infrastructure.eu). It includes constructing a wider geographical span, which has seemed to work, looking at the maps in previous figures. And it will expand the timespan of the database, by including earlier datasets from palaeoanthropology and later datasets up to the Cold War. Yet, the biggest change in

the ARIADNEplus is the integration of text mining. This will be done using Natural Language Processing and Named Entity Recognition (NLP and NER), which will innovate the portal. This action will make the portal relevant for the next decade. When looking at the future of the portal, it seems that the success of it all depends on the participating parties of the project. Open data sharing is a concept that still has to gain foothold in many European countries (Wright and Richards 2018, S64). For to share and sustainably store data is a time-consuming and expensive business. This means that there needs to an incentive to do so, and a good start would be to make sure all data that is stored should be done so in a trusted repository. For if this is not the case, the metadata may still show up in ARIADNE, while the actual data files are no longer stored in the original place, with the worst-case scenario being that they are no longer stored anywhere. ARIADNE should remain critical of the data that is entered into the portal and should stimulate FAIR data.

6.5 Conclusion

This chapter has reviewed whether the implementation of the Malta Convention article 7 has also had international connotations, as is specified in article 8 of the Convention text. This to answer how the archaeological data is made accessible in an international perspective. It became clear that article 8 has not been turned into legislation in the Dutch heritage law. This however, does not mean that there have not been international heritage projects in the European Union. These partnerships are operated by national institutes like universities, state agencies or digital repositories. An excellent example of international cooperation with the facilitating of study of and dissemination of knowledge about archaeological discoveries is the ARIADNE project. The project took place over the years 2013-2017 and aimed to make an integrated search portal for archaeological reports and databases from all over Europe. The search portal was established as a project to integrate the metadata from different digital archives and repositories, making the information searchable and the data findable, while leaving the actual data in their original place of storage. The portal needed to become searchable in through the dimensions of time, place and text. When the project ended in 2017, over 1,7 million datasets were gathered in the ARIADNE portal. The accomplishment of creating an international search portal has significantly added to the dissemination of archaeological knowledge throughout Europe. Creating opportunities to research archaeological cultures and phenomena that have not occurred within current national

borders but have been observed all over Europe. By pooling all archaeological information, it will be possible for archaeologists to study cultural phenomena from many previously excavated sites and gain new insights.

While the establishment of this portal was a huge achievement, the system did not operate flawless. When entering search words, the language in which it was entered would produce a result with records that were predominantly in the entered language. When creating an integrated international system, it should produce results from all participating European countries, and not have a bias for the language that is used to search the records as was the case. Another feature that was missing from the search engine was that it was not able to use datamining, using software to search deep text into all text records within the datafiles. This however seem to be something that will be taken up in the next phase, the project ARIADNEplus, which will run from 2019 until 2021. The portal will be expanded to contain a broader time frame, have a wider geographical reach and include a deep text search capability. Through the continuation of the Ariadne project international dissemination of archaeological information will be improved. Nonetheless it can only become a success if the original deposition within national trusted repositories is done consequently and in a sustainable way. However, in many European countries this is still not the case.

Chapter 7 Conclusion

7.1 Goal of the study

The central issue in this research has been to find out to what extent article 7 of the Malta Convention has been implemented throughout the whole archaeological sector in the Netherlands. Article 7 of the Malta Convention addresses the importance of facilitating the study of and dissemination of knowledge about archaeological research. It does that by asking all signing parties to make an overview of all information of archaeological research within their borders and keep it up to date. And it asks them to take all possible measures to create summary records of archaeological investigations for possible future scientific publications. To answer the main question, the research was split up in several issues. First by doing a literature review of issues concerning the implementation of article 7 throughout Europe and specifically in the Netherlands. Secondly, by looking at the origins of the Malta Convention and in how article 7 was implemented in the Netherlands. Thirdly, by looking at the institute in which all archaeological research has to be stored, the Data Archiving and Networked Services. Fourth, by looking at use and user data of DANS, to analyse and interpret the effectiveness of the system in the disseminating of data. Fifth, by comparing the findings of this research to the situation in England, as it also has a trusted repository which is similar to DANS, but also differs in many ways. And finally, by looking at how the implementation of article 7 has facilitated in enabling article 8 of the Convention to exchange archaeological information with other European states.

7.2 Literature review

From the literature review it became clear that article 7 does not stand on its own. With the disturber pays principle archaeological research increased, which accumulated in an expansion of the number of desk studies, borehole research, surveys and excavations. There are also many issues relating to the writing of summary reports and storing its information for future applications. The transition of archaeology performed as an academic pursuit towards becoming a commercial enterprise also created quite some controversy which has been discussed extensively throughout the archaeological discipline.

7.3 The origins of Malta

In 1992 the Convention for the Protection of the Archaeological heritage of Europe took place. The Convention was created after several decades in which archaeology had mainly become a rescue mission discipline. The Convention implemented archaeology within spatial planning policies and provided funds by the disturber pays principle. Our focus however, lies with article 7 and the question: How did the Malta Convention, and especially article 7, take shape within the Netherlands? This article can be described as the requirement of documenting archaeological research into a short scientific summary so that it can be used in future archaeological investigations and creating an overview for all archaeological research performed in the country. It has specifically been converted into legislation first in the WAMZ, and later in the Erfgoedwet. In these laws it has been specified that the basic reports, written after any archaeological research, should be entered into a national e-depot within two years after the research has taken place. The reports need to adhere to the standards given in the KNA. This standardization is illustrative of the fact that while archaeology became commercial, the Dutch state still considered archaeology significant enough to maintain control regarding quality and sustainability of the reports.
With the emphasis on standardization of archaeological reporting the danger exists of creating generalized reports. It should be monitored that academic interpretation does not disappear from archaeological reporting.

7.4 The DANS institute

The aim of this chapter was to answer the question: What does the DANS repository add to Dutch archaeology data storage? DANS started as a humanities research repository and has become the assigned Dutch national e-depot for archaeological research. DANS is an institute with an influential certification with the NESTOR seal for trusted digital repositories. With the embedding of the data from the EDNA project, many formerly inaccessible archaeological reports were included into the digital repository. All new archaeological research is stored into EASY, a subdivision of DANS. In EASY it is possible for archaeologists to store databases containing GIS files, vector maps, photos, and final reports into the system. DANS is a free service, meaning that the depositors and users are not charged for adding or using data.
DANS promotes the use of FAIR data, making data Findable, Accessible, Interoperable and Reusable. This means that it does its utmost to become part of the research cycle,

instead of the final destination of data. By standardizing metadata fields and assigning permanent identifiers like DOI, it makes the data findable for researchers in the future. To make the files accessible, it is important to make data as open as possible, while complying with the GDPR and ownership rights. Interoperability means to standardize data in such a way that in can be found and used by computer programmes or APIs. For reusability file formats should be considered, they should be durable enough to still be able to be read in the future, also it means that the data should retain its integrity, this meant that nothing can be changed once it has been put into the system. When following these principles, it is expected that the data at DANS should remain useable for other researchers in the future. As such DANS has created a durable digital data repository in which all Dutch digital archaeological data can be stored and found again for possible reuse.

7.5 DANS use and user data

To see if the system that has been set up is being reused this chapter was dedicated to the question: To what extent is the archaeological data stored at DANS being reused? In order to answer this question, first it was established that every act of downloading any archaeological files is considered an act of reusing data. To get to specific record at DANS takes several steps, which will only be undertaken when someone needs specific information. Downloading of this data is seen as an act of the study of or dissemination of archaeological information.

Because DANS works with user accounts, for which any user needs to register to gain access to most information, it was possible to gather specific information about the users and usage of archaeological databases. This was done by looking at the years 2017 and 2018, these are the two most recent complete years.

When trying to narrow down the accounts interested in archaeology, the group of professional archaeologists were added to the ones that had checked the field of archaeology as a research interest. This added up to a little over 3000 users interested in archaeology, which is one sixth of al user accounts, this can however be a distorted image, since over half of all users did not fill in any research interest. When combining the download data with user accounts it became clear that from the 75,000 downloads concerning archaeological data, nearly 20% of the downloads came from non-archaeological or anonymous accounts. This number exhibits that there is a much larger group of archaeological users, than the 3000 that have been accounted for.

The download data gathered from the statistic logs showed that archaeology was the largest in number of downloads for any discipline in 2017 and 2018. When looking at separate files that were downloaded at DANS, in 2017 60% and in 2018 50 % of the total file downloads were archaeology files. This number clearly points to the fact that the archaeological data stored at DANS is being reused in further research.
The deposition data was harder to interpret, for the number of deposited files fluctuated severely over both years, both for archaeology as for other disciplines. Yet, when looking at a broader timeframe it does show that archaeological datasets are exponentially growing in numbers in the period 2016-2018. An interesting discovery of the deposition data was the fact that from the 27,000 datasets that have been self-archived by archaeologists, this was done by only 420 users. It also shows that 87% of the archaeology users are not depositors themselves, they are only there to find archaeological information. Showing a high usage rate of archaeological datasets at DANS.
Altogether, this information points to a high usage of DANS on a regular basis by archaeologist. This reveals that previously collected data is being reused in current research. Demonstrating that archaeological data at DANS is being used to a large extent.

7.6 The situation in England

To frame the research, it is relevant to compare the situation of the Netherlands to that of another country. This was guided by the question: How is article 7 implemented in other European countries, and what can be learned from them? With a short overview of the situation in England, Sweden, Denmark, Belgium and Germany it became clear that the only other European country with such a comprehensive data storage system in place was England. To compare and contrast to the situation in the Netherlands, England was chosen, for it also has commercial archaeology, a trusted digital repository and a long academic tradition in archaeology.
Before the 1990s everything that came from archaeological research in England was stored at local museums. This changed over the 1990's and 2000's, when the excavation reports were stored at local HERs offices. The content of the Malta Convention was not turned into legislation, as it was felt that it was already implemented through environmental policies. In the last ten years, all digital field data from archaeological excavations needed to be stored at the HERs as well. Another change was that it stated

that this archaeological information should be made accessible for further research. Making archaeological information more accessible, even though it was dispersed all over England.

In 1996 the ADS was founded as a digital repository. It started as being a fully funded organisation, yet after a few years it transformed into a commercial enterprise. The use of ADS is therefore not a free service such as DANS. It has a policy where the use of data is completely free, however, on depositing the user needs to pay a one-time charge to ensure sustainable storage. The storage of archaeological information is not an obligation, it is done on a voluntary basis or done when the client mandates sustainable storage for all results.

An extensive project undertaken by the ADS is OASIS. This project was carried out to make the mass of unpublished grey literature reports digitally available. It resulted in 50,000 excavation reports being made accessible for further research. Many records are still only locally available, but now they have been mapped, making it possible to find where these records are being kept.

The biggest differences between ADS and DANS are the deposition of records at ADS being not obligatory, it being a paid service and the fact that the ADS does not store all data itself but searches through many different repositories and the search results produces a link to that repository. Whereas storing archaeological data at DANS is obligatory, free of charge and is stored within their own network. These distinctions are illustrative of the difference in attitude between the two countries, where England opts for a more liberal and capitalist approach.

This comparison with England shows that while the commercial route of storing data is an acceptable approach, it creates differences in reporting standards and it has created a very dispersed system. Without regulations from the state, an immense part of archaeological information is not properly documented or barely accessible for further research. As such, a national system with a centralised approach is preferable for enabling accessibility for further research.

7.7 International aspects of Malta

With the realisation of article 7, it becomes possible to accomplish the goals set out in article 8 of the Convention, the international dissemination of archaeological information. Which lead to the question: How is the archaeological data made accessible in an international perspective? The focus was placed upon international projects funded by the European Union to find out if this was attainable. For all archaeological information that is gathered in databases and basic reports, is recorded in the native language of the individual country. In the Netherlands this is also the case, as all reports are in Dutch.

To see how research data is being made internationally available, the ARIADNE project is reviewed. This project, that took place in 2013-2016, was a way to make a single search portal in which all of the participating partners would make their archaeological data available. The actual data would not be moved, but the metadata would be made accessible, with a working link to the actual database in which it was stored. As such, only the metadata had to be translated into English, leaving the original data in its original language. During translation of all metadata terms, it was simultaneously standardized. For the translation of archaeological terms had to adhere to one of the terms in the Getty Art and Archaeology Thesaurus. There also needed to be a time period conversion and transference of local to universal georeferenced system. A lot of the conversions were very technical in their effectuation. Combined, this made it possible to search through text, time and space.

A downside to the ARIADNE portal was its limited participation with 23 partners, which only accounted for 16 countries. This is not sufficient in searching through all of Europe's history. The search results are limited by the metadata. A more significant flaw in the system is the fact that the language into which the query is entered make a consequential difference for the results that are shown. The system shows bias for the language that is entered, causing a Dutch term to find Dutch data as the top search results.

In 2019 the project was continued for two years as ARIADNEplus. In this project, there are many more participating countries, creating a better overview of all archaeological research throughout Europe. There will also be an expansion in time, including palaeoanthropology as the oldest period and will go up to the cold war as the upper boundary of the time line. While creating an all-over better the project will also innovate the ARIADNE portal. This will be done by creating the ability for searching deep text, by

using language processing and recognitions software. The implementation of a deeptext search engine however does not overcome the language barrier of archaeological data which is rendered in different languages.
With this expansion and innovation of the portal it will surely have the potential to create a considerable impact on international archaeological research. If successful it will be able to create a conversion of nationally oriented archaeological research to a more international approach. However, this can only be the case if all archaeological data entered into the system is sustainably stored in a uniform way. Yet, in many European countries it is not even common practice to make research openly accessible. For the portal to work and be viable in the coming years, it is important that all data coheres with the FAIR principles.

7.8 Conclusion

When considering how effective the implementation of article 7 of the Malta Convention in the Netherlands currently is and if it stimulates the reuse of digital archaeological data in further research, it must be stated that it has been very effective. With the increasing of data in physical archives and decreasing of time to publish results at the end of the twentieth century, an enormous amount of archaeological information was on the verge of going to waste. The use of computers seemed to be the solution, until it became painfully clear that computer storage was also not an infinite medium. Digital storage media became superfluous at a rapid rate.
That is why article 7 of the Malta Convention is so relevant, it acknowledges the fact that while the archaeological site is lost forever, the information gathered from these excavations and research can be used endlessly. To prevent the loss of data the Dutch state intervened and found a solution, which is anchored into heritage legislation, by storing archaeological information at DANS. By being actively involved in innovation within digital repositories and software applications, DANS is taking all conceivable measures against deterioration of data. Their participation in European projects adds to its value for Dutch archaeology, which will make it easier to see archaeological sites within a broader perspective.
With the precautions taken by the Netherlands in legislation and in policy, the sustainability of archaeological information is guaranteed. The download data from DANS has proven that the reuse of archaeological data has become common practice

within archaeology. Archaeological data is preserved sustainably while still being accessible for researchers and other interested parties. The next step in reuse of archaeological data in the Netherlands is the use of text mining, to make all information inside the reports searchable, an innovation that is already being researched at this very moment.

Last but not least: it is important to realize that archaeology does not stop at the end of an excavation but remains very alive through its data reports of the past and is kept alive in the technical possibilities of the future.

Abstract

This thesis investigates how article 7 of the Malta Convention is implemented in the Netherlands. Article 7 deals with the enabling of the study of and dissemination of archaeological information. This is achieved by requiring the writing of a summary record after an excavation and a national overview of all archaeological data.
First, it focusses at how this is realised in the Netherlands through legislation and policy. All Dutch summary records and other archaeological data are stored at the DANS institute. By looking at the way in which this repository is set up, it can be stated that DANS stores data in a sustainable way.
Next it analyses the archaeological use and user data of DANS. This is achieved by inspecting the user account data on research interest and the amount that belongs to the archaeological professional's group. This group consists of ca. 3000 registered users. Further it investigates the use of DANS by looking at the downloading of archaeological datasets and files. It will evaluate the depositing of datasets within the archaeology discipline. In the use and user-analysis the focus is placed on the years 2017 and 2018. From this analysis it becomes clear that DANS is frequently used to gather archaeological data. This reuse of data can mainly be ascribed to professional archaeologists. This indicates that the archaeological data is being reused in further research. The deposition data reveals that the depositing of data is done by only a small part of the archaeological user community.
Subsequently a chapter is committed to a short overview of other European countries, with a focus on comparing the situation in England to that of the Netherlands. For while the system of both countries seems similar, with features such as commercial archaeology, a trusted repository and long archaeological tradition, there are still significant differences between both heritage management systems.
Further, there is a chapter dedicated to international collaboration on making archaeological data available internationally. Malta article 8 treats the promoting and sharing of archaeological information nationally and internationally. One step taken towards this goal is the ARIADNE project, a European Union funded project in which several partners created a data infrastructure that could search international archaeological archives. The steps to attain this search portal are described, with observations on how ARIADNE needs to be improved for it to become a true asset. The work on the portal is continued in the next phase ARIADNEplus.

In conclusion the study finds that the connotations of article 7 have been deeply embedded in archaeology practiced in the Netherlands. This has been a cooperation of state legislation, spatial planning policy, quality guidelines and storage protocols that have been drafted through an active dialogue between archaeologists and government. This has resulted in making the archives part of the knowledge cycle, by actively incorporating old data into new research.

Nederlandse samenvatting

Deze scriptie onderzoekt hoe artikel 7 van de Malta conventie is geimplementeerd in Nederland. Artikel 7 behandelt het vergemakkelijken van de studie naar en verspreiding van archeologische informatie. Dit wordt bereikt door het verplicht aanleveren van een samenvattend verslag van een opgraving en een nationaal overzicht van alle archeologische gegevens.

Als eerste wordt er gekeken naar hoe het is doorgevoerd in wetgeving en beleid in Nederland. Alle Nederlandse basisrapportages worden samen met andere archeologische onderzoeksgegevens opgeslagen bij het DANS instituut. Door bestudering van de opzet van het digitale archief, kan geduid worden dat DANS op een duurzame manier omgaat met het beheer van data.

Vervolgens vindt er een analyse plaats van de gebruiks- en gebruikersgegevens van DANS. Dit wordt gerealiseerd door te kijken naar gebruiksaccountdata en de daarin aangegeven onderzoeksinteresse of het lidmaatschap van de archeologische beroepsgroep. Deze geïnteresseerden-groep bestaat uit drieduizend geregistreerde gebruikers. Daarnaast wordt er onderzocht in welke mate DANS wordt gebruikt door bestudering van downloadgegevens van datasets en losse files. Ook wordt er gekeken naar de deponeringsgegevens. In de gebruiksanalyse wordt de focus gelegd op de jaren 2017 en 2018. Van deze analyse is gebleken dat DANS veelvuldig wordt gebruikt om archeologische data te verzamelen. Het hergebruik van de data komt vooral van de archeologische beroepsgroep. Dit wijst op hergebruik van data voor verder onderzoek. De deponeer-data toont aan dat het deponeren van archeologische data door slechts een klein gedeelte van alle archeologische gebruikers wordt gedaan.

Daarna wordt er een hoofdstuk gewijd aan een kort overzicht van de situatie in enkele Europese landen en wordt er een vergelijking gemaakt met de situatie zoals die op dit moment in England is. Hoewel er overeenkomsten zijn, zoals een commerciële archeologie, het gebruik van een *trusted repository* en een lange archeologische traditie, bestaan er toch significante verschillen tussen beide erfgoedmanagementsystemen.

Hierop volgt een hoofdstuk over internationale samenwerking tot het internationaal toegankelijk maken van archeologische gegevens. Malta artikel 8 gaat over het bevorderen van het delen van archeologische informatie op nationale en internationale schaal. Voor dit doel is het ARIADNE project opgezet, dit wordt gefinancierd door de Europese Unie waarbij verschillende partners een data infrastructuur bouwen om internationale archeologische archieven te doorzoeken. De opzet van het project wordt

beschreven en voorzien van opmerkingen over de nodige verbeteringen voor het slagen van het zoekportaal. Het project is dit jaar voortgezet onder de naam ARIADNEplus. Concluderend kan er door middel van dit onderzoek gesteld worden dat de gevolgen van de implementatie van artikel 7 diepgeworteld zijn in het Nederlandse archeologische bestel. Dit is gekomen door een aangepaste wetgeving, ruimtelijkeordeningsbeleid, kwaliteitsnormen en opslagprotocollen die zijn opgesteld in een actieve samenwerking tussen de archeologische sector en de overheid. Dit heeft geresulteerd in een situatie waarin het archeologisch archief actief deel uit maakt van de kennis-cyclus.

Bibliography

Aitchison, K., 2010. Grey Literature, Academic Engagement, and Preservation by Understanding. *Archaeologies,* 6 (2), 289-300. https://doi.org/10.1007/s11759-010-9145-5

Aloia, N., Binding, C., Cuy, S., Doerr, M., Fanini, B., Felicetti, A., Fihn, J., Gavrilis, D., Geser, G., Hollander, H., Meghini, C., Niccolucci, F., Nurra, F., Papatheodorou, C., Richards, J., Ronzino, P., Scopigno, R., Theodoridou, M., Tudhope, D., Vlachidis, A., and H. Wright, 2017. Enabling European Archaeological Research: The ARIADNE E-infrastructure. *Internet Archaeology,* 17 (43). https://doi.org/10.11141/ia.43.11

ARIADNEplus, 2019. Advanced Research Infrastructure for Archaeological Dataset Networking in Europe:. Project synopsis ARIADNE. https://ariadne-infrastructure.eu/wp-content/uploads/2019/02/ARIADNEPlus_synopsis-short.pdf, accessed on April 12, 2019.

Aspöck, E., and Geser, G., 2014. What is an archaeological research infrastructure and why do we need it? Aims and challenges of ARIADNE. *Proceedings of the 18th International Conference on Cultural Heritage and New Technologies November 2013*. Vienna: Musseen der Stadt Wien – Stadtarchäeologie, 1-10.

Bazelmans, J., 2009. Publiceren over archeologie: de omstreden oogst van Malta. *Archeobrief,* 13 (3), 8-15.

Beukers, E., 2009. *Erfgoedbalans 2009: Archeologie, monumenten en cultuurlandschap in Nederland.* Amersfoort: Rijskdienst voor het Cultureel Erfgoed.

Borgman, C. L., 2015. *Big data, little data, no data: Scholarship in the networked world.* Cambridge, MA: MIT Press.

Borgman, C. L., Scharnhorst, A., and Golshan, M. S., 2019. Digital Data Archives as Knowledge Infrastructures: Mediating Data Sharing and Reuse. *Journal of the Association for Information Science and Technology,* 70 (8), 1-31. https://doi.org/10.1002/asi.24172

Borgman, C. L., Van de Sompel, H., Scharnhorst, A., Van den Berg, H., and Treloar, A., 2015. Who Uses the Digital Archive? An Exploratory Study of DANS. *Proceedings of the Association for Information Science and Technology*, 52 (1), 1-4. https://doi.org/10.1002/pra2.2015.145052010096

Bradley, R., 2006. Bridging the two cultures - commercial archaeology and the study of prehistoric Britain. *The Antiquaries Journal,* 86, 1-13. https://doi.org/10.1017/S0003581500000032

Brandsen, A., Lambers, K., Verberne, S., and Wansleeben, M. S., 2019. User Requirement Solicitation for an Information Retrieval System Applied to Dutch Grey Literature in the Archaeology Domain. *Journal of Computer Applications in Archaeology,* 2 (1), 21-30. http://doi.org/10.5334/jcaa.33

Bussemaker, M. 2015, March 30. Bundeling en aanpassing van regels op het terrein van cultureel erfgoed (Erfgoedwet): 34109-7. Den Haag: Tweede Kamer der Staten-Generaal.

Council of Europe, 1992a. European Convention on the Protection of the Archaeological Heritage (Revised). *Council of Europe Treaties,* 143. https://conventions.coe.int/Treaty/en/Treaties/Html/143.htm, accessed on November 11, 2018

Council of Europe., 1992b. *Explanatory Report to the European Convention on the Protection of the Archaeological Heritage (Revised).* Valletta: Council of Europe.

Demoule, J. 2012. Rescue Archaeology: A European View. *Annual Review of Anthropology,* 4, 611-626.

Department for Communities and Local Government, 2006. *Planning Policy Guidance 16: Archaeology and planning.* London: Department for Communities and Local Government.

Department for Communities and Local Government, 2010. *Planning Policy Statement 5: Planning for the Historice Environment.* Norwich: The Stationary Office.

Erfgoedinspectie, 2016. *Graven in depots: behoud en toegankelijkheid in provinciaal archeologische depots.* Den Haag: Ministerie van Onderwijs, Cultuur en Wetenschap.

Erfgoedinspectie, 2018. *Verder graven in depots: behoud en toegankelijkheid in gemeentelijke archaeologische depots.* Den Haag: Ministerie van Onderwijs, Cultuur en Wetenschap.

Geser, G., and Selhofer, H., 2014. *First report on Users' Need.* ARIADNE. http://legacy.ariadne-infrastructure.eu/wp-content/uploads/2019/07/ARIADNE_D2-1_First_report_on_users_needs.pdf, accessed on March 8, 2019.

Gilissen, V., 2013. Past the opening: building towards the present, on-going dissemination of Dutch archaeological data as part of the DANS archive. *Conference Proceedings Opening the Past 2013: Archaeology of the Future.* Pisa.

en, V., and Hollander, H., 2017. Archiving the past while keeping up with the times. *Studies in Digital Heritage*, 1 (2), 194-205. https://doi.org/10.14434/sdh.v1i2.23238

Hollander, H., 2017. Saving Treasures of the World Heritage at the Digital Archive DANS. *Internet Archaeology,* 43. https://doi.org/10.11141/ia.43.9

Johansen, B., and Mogren, M., 2014. Valletta and beyond - ideas and practices in Sweden. In V. M. Van der Haas, and P. A. Schut (eds), *The Valletta Convention: Twenty years after Benefits, Problems, Challenges. EAC Occassional paper* (9). Brussel: Europae Archaeologia Consilium, 143-49.

Kansa, E. C., 2011. New Directions for the Digital Past. In E. C. Kansa, S. Whitcher Kansa, and E. Watrall (eds), *Archaeology 2.0: New Approaches to Communication and Collaboration*. Los Angeles: The Cotsten Institute of Archaeology Press, 1-26

Knoop, R., 2008. Minder somber over Malta. *Archeobrief,* 12 (02), 36-37.

Kristiansen, K., 2009. Contract archaeology in Europe: an exepriment in diversity. *World Archaeology,* 41 (4), 641-648. https://doi.org/10.1080/00438240903371486

Larsson, A. M., 2017. Digitising the Archaeological Process at the Swedish National Heritage BAoard: producing, managing and sharing archaeological information. *Internet Archaeology,* 43. https://doi.org/10.11141/ia.43.6

Lyne, E., 2013. Heritage legislation: The Republic of Ireland and Denmark's heritage laws and their consequences for archaeology and archaeologists. *Arkæologisk Forum,* 28, 35-9.

Merriman, N., 1993. The use of collections: the need for a positive approach. In E. Southworth (ed.), *Picking Up The Pieces- Adapting to Change in Museums and Archaeology. The Museum Archaeologist 18. Conference Proceedings Sheffield 1991*. Liverpool: Society of Museum Archaeologists, 10-17

Merriman, N., and Swain, H., 1999. Archaeological Archives: Serving the Public Interest? *European Journal of Archaeology,* 2 (2), 249-67.

Mikkelsen, M., 2012. Development-led archaeology in Denmark. In L. Webley, M. Van der Linden, C. Haselgrove, and R. Bradley, *Development-led Archaeology in North-West Europe: Proceedings of a Round Table at the University of Leicester, 19th-21st November 2009*. Oxford: Oxbow, 117-27

Ministerie van Onderwijs, Cultuur en Wetenschap, 2007. Wet op de Archeologische Monumentenzorg. Den Haag: Ministerie van Onderwijs, Cultuur en Wetenschap. https://wetten.overheid.nl, accessed on December 2, 2018.

Ministerie van Onderwijs, Cultuur en Wetenschap, 2017. *Erfgoedbalans 2017.* Amersfoort: Rijksdienst van het Cultureel Erfgoed.

Ministry of Housing, Communities and Local Government, 2019. *National Planning Policy Framework.* Norwich: Her Majesty's Stationary Office.

Olivier, A., and Van Lindt, P., 2014. Valleta Convention perspectives: an EAC survey. In V. M. Van der Haas, and P. A. Schut (eds), *The Valletta Convention: Twenty years after: Benefits, Problems, Challenges. EAC Occassional paper* (9). Brussel: Europae Archaeologia Consilium, 165-76.

Otten, T., 2012. Development-led archaeology in Germany: the legal framework: the example of North Rhine-Westphalia. In L. Webley, M. Van der Linden, C. Haselgrove, and R. Bradley, *Development-led Archaeology in North-West Europe: Proceedings of a Round Table at the University of Leicester, 19th-21st November 2009*. Oxford: Oxbow, 100-7.

Raad van State, 1988. Monumentenwet 1988. Den Haag: Raad van State. https://overheid.wetten.nl, accessed on December 2, 2018.

Raad van State, 2017. Erfgoedwet. Den Haag: Raad van State. https://overheid.wetten.nl , accessed on December 2, 2018.

Raad voor Cultuur, 2001. *Advies interimbeleid : Verdrag van Valletta.* Advies aan Staatssecretaris F. van der Ploeg, Den Haag.

Raad voor Cultuur, 2011. *Advies evaluatie Wet op de Archeologische MonumentenZorg (WAMZ) en Besluit Archeologische MonumentenZorg (BAMZ).* Advies aan Staatssecretaris H. Zijlstra, Den Haag.

Raemakers, D., 2007. Het einde van Malta? *Archeobrief,* 12, 17-20.

Richards, J., 2017. Twenty Years Preserving Data: A View from the UK. *Advances in Archaeological Practice,* 5 (3), 227-237. https://doi.org/10.1017/aap.2017.11

Rijksdienst voor het Cultureel Erfgoed, 2016. Beleidskader internationaal cultuurbeleid 2017-2020. Amersfoort: Beleidsnota 01-01-2016.

Rijksdienst voor het Cultureel Erfgoed, 2019. Uitstel, ontheffings-, en handhavingsbeleid ten aanzien van de rapportageplicht archeologische opgravingen. Amersfoort: Beleidsnota 01-01-2019.

Theunissen, L., and Deeben, J. 2011. Een onderzoek naar de effectiviteit van de archaeologische onderzoeksketen voor beeldvorming over het verleden. In *Vragen over Malta: Rapportage Archeologische Monumentenzorg,* 196. Amersfoort: Rijksdienst voor het Cultureel Erfgoed, 7-40

Van den Dries, M. H., 2011. The Good, the Bad and the Ugly? Evaluating Three Models of Implementing the Valletta Convention. *World Archaeology*, 43(3), 594-604. https://doi.org/10.1080/00438243.2011.624790

Van der Hoeven, M. J., 2006. Wijziging van de Monumentenwet 1988 en enkele andere wetten ten behoeve van de archeologische monumentenzorg mede in verband met de implementatie van het Verdrag van Valletta (Wet op de archeologische monumentenzorg): Memorie van Antwoord 29259-D. Den Haag: Eerste Kamer der Staten-Generaal.

Van Londen, H., Vossen, N., Schlaman, M., and Scharringhausen, K., 2014. *Discovering the Archaeologists of the Netherlands 2012-14.* Amsterdam: University of Amsterdam.

Van Marrewijk, D., and Brandt, R., 1997. Dreaming of Malta. In W. J. Willems, H. Kars, and D. P. Hallewas, *Archaeological Heritage Management in the Netherlands : Fifty years State Service for Archaeological Investigations*. Assen: Van Gorcum, 58-75.

Webley, L., Vander Linden, M., Haselgrove, C., and Bradley, R., 2012. Development-led Archaeology in North-West Europe: Proceedings of a Round Table at the University of Leicester 19th-21st November 2009. Oxford: Oxbow.

Wilkinson, M.D., Dumontier, M., Aalbersberg, I.J., Appleton, G., Axton, M., Baak, A., Blomberg, N., Boiten, J., Bonino Da Silva Santos, L., Bourne, P.E., Bouwman, J., Brookes, A.J., Clark, T., Crosas, M., Dillo, I., Dumon, O., Edmunds, S., Evelo, C.T., Finkers, R., Gonzalez-Beltran, A., Gray, A.J.G., Groth, P., Goble, C., Grethe, J.S., Heringa, J., 't Hoen, P.A.C., Hooft, R., Kuhn, T., Kok, R., Kok, J, Lusher, S.J., Martone, M.E., Mons, A., Packer, A.L., Persson, B., Rocca-Serra, P., Roos, M., Van Schaik, M., Sansone, S., Schultes, E., Sengstag, T., Slater, T., Strawn, G., Swertz, M.A., Thompson, M., Van Der Lei, J., Van Mulligen, E., Velterop, J., Waagmeester, A., Wittenburg, P., Wolstencroft, K., Zhao, J., and B. Mons, 2016. The FAIR Guiding Principles for Scientific Data Management and Stewardship. *Scientific Data,* 3, 1-9. https://doi.org/10.1038/sdata.2016.18

Willems, W.J.H., 2007. The Work of Making Malta: The Council of Europe's Archaeology and Planning Committee 1988-1996. *European Journal of Archaeology,* 10 (1), 57-71. https://doi.org/10.1177/1461957108091482

Willems, W.J.H., 2014. Malta and its Consequences: A Mixed Blessing. In V. M. Van der Haas, and P. A. Schut (eds), *The Valletta Convention: Twenty years after: Benefits, Problems, Challenges. EAC Occassional paper* (9). Brussel: Europae Archaeologia Consilium, 151-56.

Willems, W.J.H., and Van den Dries, M. H., 2007. The origins and development of quality assurance in archaeology. In W. J. Willems, and M. H. Van den Dries (eds), *Quality Management in Archaeology*. Oxford: Oxbow Books, 1-12.

Wouters, W., 2012. Development-led archaeology in Flanders: the legal framework. In L. Webley, M. Van der Linden, C. Haselgrove, and R. Bradley, *Development-led Archaeology in North-West Europe: Proceedings of a Round Table at the University of Leicester, 19th-21st November 2009*. Oxford: Oxbow, 22-8.

Wright, H., and Richards, J. D., 2018. Reflections on Collaborative Archaeology and Large-Scale Online Research Infrasructures. *Journal of Field Archaeology*, 43 (1), S60-S67. https://doi.org/10.1080/00934690.2018.1511960

Zoetbrood, P.A.M., Montforts, M. J., Roorda, I. M., and Wiemer, R., 1997. Documenting the Archaeological Heritage. In W. J. Willems, H. Kars, and D. P. Hallewas, *Archaeological Heritage Management in the Netherlands: Fifty years State Service for Archaeological Investigations*. Assen: Van Gorcum, 330-345.

Internet pages

http://erfgoed.brussels/ontdekken/de-brusselse-erfgoedinventarissen accessed on 9 June 2019

http://intarch.ac.uk/journal/issue43/9/9.html accessed on 8 March 2019

http://www.kulturarv.dk/fundogfortidsminder/ accessed on 9 June 2019

http://www.parthenos-project.eu/about-the-project-2 accessed on 30 April 2019

https://agencewallonnedupatrimoine.be/publications-documentations/ accessed on 9 June 2019

https://archaeologydataservice.ac.uk/advice/FileFormatTable.xhtml accessed on 10 June 2019

https://cordis.europa.eu/project/rcn/106384/factsheet/en accessed on 8 March 2019

https://cultureelerfgoed.nl/nieuws/tienduizenden-archeologische-rapporten-digitaal-beschikbaar accessed on 8 March 2019

https://dans.knaw.nl/en accessed on 31 May 2019

https://dans.knaw.nl/en/about/organisation-and-policy/collaboration accessed on 3 August 2019

https://dans.knaw.nl/en/about/services/easy/information-about-depositing-data/before-depositing/file-formats?set_language=en accessed on 2 August 2019

https://dans.knaw.nl/nl/over/diensten/training-consultancy accessed on 2 August 2019

https://dans.knaw.nl/nl/over/organisatie-beleid/beleid-en-strategie/preservatie-plan-data-archiving-and-networked-services-dans accessed on 2 August 2019

https://dans.knaw.nl/nl/over/organisatie-beleid/beleid-en-strategie/preservatie-plan-data-archiving-and-networked-services-dans accessed on 8 March 2019

https://easy.dans.knaw.nl/doc/sword2.html accessed on 31 May 2019

https://erfgoedmonitor.nl/indicatoren/archeologisch-onderzoek-aantal-onderzoeksmeldingen accessed 30 April 2019

https://historicengland.org.uk/advice/hpg/heritage-assets/hers/ accessed on 5 August 2019

https://perio.do/en/ accessed on 30 April 2019

https://www.carare.eu/about/ accessed on 30 April 2019

https://www.coretrustseal.org/why-certification/certified-repositories/ accessed on 5 August 2019

https://www.heritagegateway.org.uk/gateway/about/default.aspx accessed on 5 August 2019

https://www.kb.nl/organisatie/onderzoek-expertise/informatie-infrastructuur-diensten-voor-bibliotheken/registration-agency-nbn accessed on 28 March 2019

https://www.netwerkdigitaalerfgoed.nl/kennis-en-voorzieningen/digitaal-erfgoed-houdbaar/persistent-identifiers/ accessed on 28 March 2019

https://www.onroerenderfgoed.be/regelgeving accessed on 9 June 2019

https://www.portable-antiquities.nl/pan/#/public/about accessed on 3 August 2019

https://www.raa.se/in-english/digital-services/about-fornsok/ accessed on 8 June 2019

https://www.sikb.nl/archeologie/kna-leidraden accessed on 5 April 2019

https://www.sikb.nl/archeologie/richtlijnen/brl-4000 accessed on 30 April 2019

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