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ANDREA D'ANDREA
(CISA, Università degli Studi di Napoli "L'Orientale") (UNO)

MANAGING ARCHAEOLOGICAL KNOWLEDGE: THE EXPERIENCE OF THE CENTRO INTERDIPARTIMENTALE DI SERVIZI PER L'ARCHEOLOGIA (CISA)[*]

Introduction

CISA, *Centro Interdipartimentale di Servizi per l'Archeologia* (Interdepartmental Archaeological Services Centre) was founded in 1992 at Istituto Universitario Orientale, Napoli (IUO, now UNO) in order to support the different research activities and archaeological missions formerly conducted under the auspices of three existing Departments: Studi Asiatici, Studi del Mondo Classico e del Mediterraneo Antico, and Studi e Ricerche su Africa e Paesi Arabi.[1]

CISA aims at increasing the use of technologically advanced research facilities and tools, such as computer-based archaeological cartography, multimedia and computer-based systems for the classification and recording of archaeological findings and databases.

CISA also actively supports authorities charged with cultural heritage management in Italy and abroad. Several collaboration agreements have been signed between Italian and foreign institutions and agencies. Moreover, MA and PhD training programmes on archaeological and cultural heritage management topics are offered to the staff of foreign institutions in Italy and

[*] I would like to thank Prof. Bruno Genito for having invited me to present in this volume the main activities performed by CISA. CISA's website is www.unior.it/ateneo/231/1/cisa-centro-interdipartimentale-di-servizi-di-archeologia.html. All URLs quoted in this paper were visited on 2 February 2015.

[1] CISA was only inaugurated on 7 December 1995, three years after its foundation. For this event a short booklet entitled *Attività Archeologiche dell'Istituto Universitario Orientale* (AA.VV 1995) was published in order to provide an overview of the various research activities carried out by the archaeologists of Istituto Universitario Orientale. In 2012, with the new statute of the Università di Napoli "L'Orientale", CISA became a service centre.

at their home institutions in collaboration with the Italian Ministry of Foreign Affairs.[2]

In the last ten years, thanks to its having taken part in many national and international projects, the initial endowment of devices and instruments has been increased with two shift-phase laser scanners, a differential GPS system and two total stations.[3] At present CISA provides the different "L'Orientale" archaeological teams with facilities to carry out topographic surveys and prepare detailed digital maps. CISA, furthermore, can render assistance in the acquisition and processing of spatial data and the creation of digital 3D models of architectures and archaeological monuments.

CISA's contribution to data processing, acquired during activities in the field, is one of its most important aims; CISA promotes and encourages new methods and techniques applied to archaeological investigation through a multidisciplinary approach.

On the basis of an inter-disciplinary strategy, open to innovation and integration with other scientific domains, over the years CISA has submitted many proposals and implemented many projects aimed at acquiring and managing archaeological information. This approach, largely founded on the use of ICT (*Information and Communication Technology*), has been followed without giving up the traditional ways of investigating the past.

This paper gives a short overview of the most relevant research conducted by CISA in the course of its twenty-three years of activity. It particularly highlights the topic of archaeological data sharing and accessibility; these perspectives are without doubt the most suitable field for the most important rethinking of archaeological methodology.

The projects and research mentioned above show that CISA has opened up to new methods since 2002, also in different fields such as geophysics, geomorphology and remote sensing.

The decision to list the projects in chronological order will probably help the reader to understand changes and evolution in the topics dealt with in this short history. Hopefully, furthermore, in this way it will be easier to

[2] CISA organised three masters for post-graduate students: in 2003-2004 ARM (*Archaeological Resouces Management*) granted by the Ministero Italiano per la Ricerca e l'Università in competition 4391/2001 "Piano Operativo Nazionale - *Regioni dell'Obiettivo 1 - Ricerca Scientifica, Sviluppo Tecnologico, Alta Formazione 2000-2006*; in 2005 "*Scuola Internazionale di Archeologia Classica ed Orientale*" granted by the Ministero Italiano per la Ricerca e l'Università in the INTERLINK competition; and, finally, in 2010-2011 "*Egittologia. Metodologie di Ricerca e Nuove Tecnologie*".

[3] In 2014 CISA bought a low-cost drone for aerial photogrammetry.

understand the different approaches adopted during the course of CISA's life in order to contribute to forming a shared science.

These results have been reached thanks to precious teamwork involving different CISA members and by offering the research sectors traditionally active in different geographical areas, from the Mediterranean to the Far East, a common ground of rethinking and testing that in some cases has influenced the continuation of investigations in the field.

Regional Competences Centre - INNOVA[4]

In 2003 CISA contributed, along with other public or private regional research institutions, to the creation of a *Centro per lo Sviluppo ed il Trasferimento dell'Innovazione nel Settore dei Beni Culturali e Ambientali*.[5]

The aims of the Centre, called INNOVA, were:

- to provide a robust and stable link among INNOVA, the regional territory and the potential stakeholders interested in the use of the research work, services and innovations developed by INNOVA;
- to facilitate integration among the research groups belonging to different regional institutions and coming from different domains;
- to ensure constant connection with development and management strategies;
- to develop a network of advanced services addressed at internal or external stakeholders;
- to support all the task groups by setting up an efficient and effective monitoring and evaluating system.

CISA, with the Dipartimento di Scienze della Terra of the Naples Università Federico II di Napoli, the Italian Centro Nazionale delle Ricerche (CNR) and the Università di Napoli "Parthenope", provided an important contribution to the development, in the diagnostic area, of work package I.1

[4] www.innova.campania.it

[5] The tender for the Centre was called in the framework of the "*Programma Operativo Regionale 2000/2006 Asse prioritario di riferimento 3 - Risorse Umane - Misura 3.16 Sviluppo della Rete Regionale dei Centri di Ricerca Orientata al Trasferimento Tecnologico a Favore dei Sistemi Locali di Sviluppo e delle Specializzazioni Produttive Locali*". CNR was the leader of the proposal. Among the equipment to be acquired in the project, CISA required a laser scanner and a differential GPS system; these devices were bought in the period 2003-2005 and were then assigned to CISA.

"*Integrated Methodologies for archaeology, geo-physics and geology*"; the aim of this was to design and implement a multidisciplinary methodology for setting up innovative mobile equipment. In this WP, intended to provide non-destructive tools for the investigation of unearthed areas and to define the potential or the risks of an archaeological zone, CISA was the leader of action I.1.2 "*Developing of integrated archaeological techniques for the knowledge and valorisation of archaeological monuments*".

In particular this activity focused on:

- the definition of new and non-destructive ways of investigating and exploring archaeological areas with innovative methodologies for digital topographic and detailed geomorphologic surveys;
- the integration of spatial data acquired with micro-relief with data coming from geological and geophysical investigations.

The WP intended to integrate mobile geophysical methods in archaeological research in order to outline the archaeological potential of an unearthed area. Along with the traditional ways of investigation, the WP dealt with the experimentation and development of modern techniques for acquiring and rendering 3D data; the challenge was the implementation of interpretative reconstructions of archaeological remains integrated with those coming from the surface.[6]

The aim of the project was to promote much more integrated research into the cultural heritage, facilitating a discussion among the specialists and professionals from different research areas. The project was mainly based on the idea that only by integrating archaeologists in a wider group would it be possible to obtain results in the form of historical interpretation, territorial development, cultural enhancement and opportunities for tourism at the same time and without duplicating efforts. Thanks to this new approach, based on non-destructive methodologies, it would be possible to investigate wide areas rapidly and identify the archaeological potential of unearthed or partially investigated areas.

The challenge was to map all the relevant archaeological sites quickly and orient research. To attain these objectives it was necessary to set up a new methodology based on a multidisciplinary approach involving scholars

[6] Some tests, carried out in 2006, have been shown in a short paper published in Rilievi (2007).

expert both in traditional archaeological practices and in the use of modern technologies for 3D data acquisition and rendering.

The aims of the WP have been only partially achieved. It emerged during the implementation of the project that integration is certainly the only way to improve research and reduce costs. By providing the correlated data coming from different domains (archaeology, spatial analysis, geography, physics, geophysics, geology, computer sciences) reliably, furthermore, different interpretations and alternative hypotheses may be proposed without replicating research or data acquisition campaigns. Notwithstanding the positive results achieved, the absence of a clear strategy for the long-term preservation of data and standards of classifying and archiving data handicapped the integration and creation of an organic vision of the archaeological project.

In March 2011 the original structure of the Centre changed with the creation of a private company.[7] Currently Innova represents the natural evolution of the Regional Competences Centre. The main target of the new Innova is to provide services[8] and to support any initiative or project in the fields of improvement in innovation and enhancement of the regional cultural heritage.

Archeozone: A portal for Classical and Oriental archaeology (Fig. 1)

Data accessibility and data sharing were the topics of a research project started in 2003 in the framework of the project "*Archeozone*: *Un portale per l'Archeologia Classica e Orientale*" sponsored by the Ministry for the Universities and Research (MIUR).[9]

[7] The company, called *Centro per lo Sviluppo ed il Trasferimento dell'Innovazione nel Settore dei Beni Culturali e Ambientali,* INNOVA, was founded by the Università di Napoli "Federico II", "Seconda Università", "L'Orientale" and "Parthenope", the Università of Salerno and the Consiglio Nazionale delle Ricerche

[8] Innova deals with research and development activities and provides technological services, training and management for the regional cultural heritage. CISA is involved in the sector for systems for digital surveys in archaeology. The purpose of this activity is to provide geo-referenced and digital 3D data for archaeological investigation: services are provided for the diagnostic and post-processing phases.

[9] The proposal was submitted in the framework of tender 68/2002 called by the Italian Ministry for Universities and Research in the "*Piano Operativo Nazionale 2000-2006, Asse II "Ricerca Scientifica, Sviluppo Tecnologico, Alta Formazione*", Measure II.2,"*Società dell'Informazione per il Sistema Scientifico Meridionale*", Action b "*Infrastrutture e sistemi innovativi per l'apprendimento e la conoscenza: realizzazione di applicazioni multimediali e centri di servizio per la diffusione delle ICT*".

The project involved all the archaeologists of "L'Orientale" without any distinction in terms of areas, regions or chronological periods and supported all the different archaeological research work and activities. The aims of the proposal were to inaugurate new ways of making scientific data available online, preserving big archives through massive digitisation and, finally, communicating all the research undertaken by the University to improve international cooperation on the web.

The aims of this project were to promote and spread the use and the integration of networks in universities, both to enhance the quality and the effectiveness of their scientific services and to improve the technological level of the work by encouraging new and integrated research.

The challenge of *Archeozone* was to implement a tool which would allow researchers to publish their data rapidly, customise the virtual spaces and improve the communication and sharing of digital archives among scientific communities located in different countries. The aim of the creation of the *Archeozone* portal was to try to overcome the fragmentation of research work by providing clusters in order to publish heterogeneous digital archives and sources simply; the project focused on setting up a simple pipeline to access and reuse the scientific data sets and increase contacts among archaeologists. Furthermore these collections could be easily reused to support training and e-learning actions.

Archeozone was to integrate and share different types of data such as forms, photos, bibliography, plans, drawings, reports and notes acquired by various research teams.[10] Frequently these archives contained images and information about ancient sites which have disappeared or have been destroyed, the only evidence of past civilisations. This inestimable patrimony had to be made available for a wider national and international audience, including private and public institutions responsible for safeguarding and promoting the cultural heritage.

[10] www.archeozone.it (the website is not accessible now, as it is under development). The technology available when the project was implemented, did not allow easy customisation of portals or CMS (Content Management System). Often the code was not free or required a high level of skill in programming websites. So after the launch of the portal and its publication online, the updates of the programme in the course of years have been modest. The experience, nevertheless, acquired during the project provided new stimuli and opportunities for dealing with the same topic in other research activities. In particular this approach will characterise the DICOR project, a recent and ongoing project also addressed at the migration of the original Archeozone to a simpler and easier CMS to manage archaeological datasets. DICOR "*Divulgazione e Condivisione Tecnologie, Saperi e Servizi dell'Orientale*", funded in the framework of Regional Law 13/2004, focuses on the digitisation process and metadata creation of paper sources (maps, photos, films, etc.) related to the research carried out by Naples scholars of the Università "L'Orientale" di Napoli.

Currently the portal hosts a wide *corpus* of archaeological collections gathered during a long experience of investigation carried out by the researchers of the Università "L'Orientale" in regions stretching from Europe to the Far East. The publication online of these datasets intended to contribute to the strengthening of research, facilitating interactive communication and intensifying scientific cooperation.

By exploiting synergies and links with other cultural and scientific institutions and research centres, another aim of the portal was to consolidate "L'Orientale's" relationships with the areas concerned and with those public and private teams with which it collaborated in archaeological investigations.

The project was completed 10 years ago and now we must acknowledge that the objectives, although they were ambitious and forward-looking, have not been achieved completely. The virtual spaces have been customised for all research work, and reports, photos and drawings have been uploaded and made available. In a few case studies the portal hosts databases of collections of small finds, ceramics, etc. Notwithstanding the original aims, *Archeozone* has never been updated after its launch in 2005, perhaps owing to the difficulty in the use of a code based on *dot.net* and *asp.net*.

The lack of a metadata schema, furthermore, makes it more difficult to search for data. Thus the portal has a photo taken 10 years ago and the design and, above all, the idea of exploiting the network to increase and strengthen collaboration are still evaluable. Thanks to the development and the diffusion of international metadata schemas and to the implementation of an easier and customisable CMS, portals and other tools for publishing online digital archives can be created.[11]

All these aspects, handled with greater attention in another project, ALUKA, were to constitute a fundamental aspect of CISA'S experience and projects in the management and processing of archaeological knowledge.

The ALUKA digital library[12] (Fig. 2)

Aluka is an international, collaborative initiative building an online digital library of collections from and about Africa. The website includes a

[11] For an in-depth review on the open-source CMS available see the following web address: www.opensourcecms.com/scripts/show.php?catid=1&category=CMS%20/%20Portals. The site reviews about 190 programs, principally based on standard programming languages for the web.

[12] www.aluka.org

wide variety of high quality materials provided by different partners, ranging from archival documents, books and reports, to three-dimensional models, maps and photos.

Aluka's informational website was launched in June 2006. The first release of the digital library took place in February 2007.[13] The portal stores about 300,000 data from about 90 collections widely dispersed and difficult to access. One of the main objectives of the project was to provide African researchers and students with study materials originally from Africa, but now out of their reach; certain materials, such as high resolution images and GIS databases, are valuable for specialised research purposes.

Aluka hosts a rich series of datasets representing a major freely accessible digital archive providing new opportunities for research, teaching and broader public discussion. The principal audience is the higher education and research community, both in Africa and around the world, including scholars and cultural institutions. All the materials stored in the digital library have been selected according to a rigorous process involving local institutions and a dozen international institutions around the world.

By aggregating these materials online, the Aluka collections link materials that are physically scattered, opening up new possibilities for research and teaching. The process of building and working with the collections also fosters international networks of students and researchers with similar interests, while Aluka's web-based platform provides powerful tools for collaboration and sharing information.

In 2006, thanks to an agreement with *The Aluka Initiative* of ITHAKA HARBORS Inc., New York, CISA shared its collection of field notes, reports, and images from the archaeological excavations and survey at Bieta Giyorgis and other sites in the Aksum region (Tigrai, Ethiopia) with Aluka.[14] QTVR videos of a three-dimensional model of an ancient Aksumite building are also available.[15]

The CISA collection includes 336 records,[16] ranging from small items (ceramics, coins, etc.) to photos, and shows discoveries carried out in over

[13] In 2008 Aluka became part of JSTOR.

[14] CISA's group was coordinated by Rodolfo Fattovich, Professor of Ethiopian Archaeology at UNO, whose work at Aksum began in 1993. Until 2002, the project was jointly conducted with Boston University (Boston, MA, USA) and within the framework of a wide international network of scientific collaborations. The main focus of the project is reconstructing the development of the Kingdom of Aksum and achieving an overview of changes in the man-environment relationships across the entire region.

[15] www.aluka.org/action/showMetadata?doi=10.5555/AL.CH.DOCUMENT.unomovex0_ 001

[16] www.aluka.org/action/showCompilationPage?doi=10.5555%2FAL.CH.COMPILATION.COLLECTION-MAJOR.AAE

20 years of research activities in the field. The records have been encoded according to the Dublin Core metadata schema[17] with additions for the Aluka digital library.[18] The adoption of a descriptive metadata standard ensures a high quality level of integration of heterogeneous materials coming from different areas, contexts and periods and from different institutions and scholars. Dublin Core is a simple way of finding records easily by integrating data set encoded in different digital formats, acquired in research activities frequently carried out with different aims and methodologies.

The topic of the integration of disparate archaeological digital sources, only marginally examined in the implementation of *Archeozone*, was to be the starting point for another CISA challenge in the framework of the European EPOCH Project.

The EPOCH network of excellence[19]

EPOCH was a network of about a hundred European cultural institutions joining their efforts to improve the quality and effectiveness of the use of information and communication technology for the cultural heritage. Participants included university departments, research centres, heritage institutions such as museums or national heritage agencies and commercial enterprises, which came together in the endeavour to overcome the fragmentation of current research in this field.

The overall objective of the network was to provide a clear organisational and disciplinary framework for increasing the effectiveness of work at the interface between technology and the cultural heritage of human experience represented in monuments, sites and museums. This framework encompassed all the various work processes and flows of information from archaeological discovery to education and dissemination. It enabled users to find out where the bottlenecks in the end-to-end process were currently located and this, in turn, made it possible to focus, as a matter of priority, on what direction research should take.

The experience acquired in the field of the use of metadata in the implementation of Aluka provided CISA with a new perspective on the

[17] dublincore.org

[18] www.aluka.org/page/help/tipsTechniques/fieldsContrib.jsp. For the content of the contributions, available metadata consist only of those supplied by the contributors.

[19] www.epoch.eu. The project was founded in the Sixth Framework Programme (Contract IST-2002-507382).

adoption of a new approach in terms of data integration and interoperability compared with the strategy followed in Archeozone, where the same topic was faced with the creation of common virtual highly customisable spaces linked to different academic research activities. In EPOCH the topic was dealt with in the Archaeological Documentation for the Semantic WEB group (WP.2.4.7) and more in general in Standards (WP.4.2); CISA in particular was engaged with interoperability, semantics, ontologies and the application of the ISO CIDOC-CRM standard to archaeological datasets.

The greatest challenge of the EPOCH project was that it brought together specialists from diverse fields, made them collaborate and thereby fostered a much deeper interdisciplinary understanding of the diverse research problems in different fields. The goal of the jointly executed research work package in EPOCH was the analysis and development of digital tools for the cultural heritage field and research into these tools. Emphasis was placed on defining a common infrastructure that provided interoperability, integration and sustainability.

Several tool chains for the cultural heritage were investigated and a prototype for the mapping and management of cultural heritage information in a semantic web context was developed by PIN (Università di Firenze), CISA and EDD (University of Oslo, Norway). The program, called AMA (Archive Mapper for Archaeology),[20] dealt with the implementation of a semi-automated procedure in order to map cultural heritage data to CIDOC-CRM, ISO 21127.[21] The AMA project aimed at overcoming mapping problems through the implementation of a flexible tool for facilitating the mapping of different archaeological and museum collection data models (with various structured, as well as non-structured, data, i.e. text description) to a common standard based on CIDOC-CRM. The necessary information was extracted from these mappings to convert individual datasets to a common CIDOC-CRM compliant structure. AMA is a tool created for mapping existing archaeological data to a standard ontology providing a rich and powerful data structure that simplifies the process of integration and interoperability between existing and future archives. The tools designed and implemented also thanks to the contribution of CISA are a good example of the achievements of this project.

[20] www.epoch.eu/index.php?option=com_content&task=view&id=222&Itemid=338
[21] www.cidoc-crm.org

EPOCH was a large and complex project, encompassing many different organisations and disciplines, each of which contributed to the success of the project. The network also reached a very wide section of the community through regional meetings, technical events, publicity, publications and training. EPOCH has left a rich collection of works still available online. At the last count around 180 papers and 22 books had been published by EPOCH partners based on work which was partially supported through the project.[22]

3DICONS (3D Digitisation of Icons of European Architectural and Archaeological Heritage)[23] (Figs. 3, 4).

The last project, ended on 31st January 2015, summarises the experience acquired by CISA in the last years in the field of data sharing and metadata creation and also at the level of the developing technologies for 3D data acquisition, post-processing and publication online. 3DICONS is also important in CISA's history from another point of view: for the first time CISA coordinated a large European partnership for the implementation of an ambitious project in the field of creating 3D models to be provided to Europeana, the largest European digital library.[24]

As the general public is becoming increasingly familiar with 3D content, the challenge of 3DICONS was to provide high quality 3D cultural heritage material. The project's particular aim was to exploit existing tools and

[22] Many of the research activities carried out by CISA in the framework of EPOCH have been published by Andrea D'Andrea (2006) under the supervision of Franco Niccolucci. The book is in the EPOCH Collection.

[23] 3dicons-project.eu/. 3D-ICONS was a pilot project funded under the European Commission's ICT Policy Support Programme. 3D-ICONS lasted for three years from 1 February 2012. For more details on the project and on its contribution see (D'Andrea 2012, 87-109; D'Andrea, Fernie 2013, 159-181).

[24] www.europeana.eu/portal. The Europeana Project was launched in 2008 under the name of EDLnet (*Europeana Digital Library*) with the goal of giving access to over 10 million digital objects by 2010. At the moment the portal is progressing in two directions. As one of the most important objectives of *Europeana* is to give access to the European heritage, its work is dedicated to increasing the number of available records and developing specific protocols to allow publication and data retrieval. For these reasons, while the European Commission has launched specific projects with the goal of contributing to *Europeana* by funding projects aimed at digitising new collections, archives and geographical maps, developers are working on new features including tools and services expanding the search engine functionalities. There are numerous projects - the Europeana Group - that are contributing to the implementation of technological solutions and providing content to Europeana. These projects are run by different cultural heritage institutions, and are funded in part by the European Commission's e-Contentplus programme and CIP ICT-PSP Programme (Competitiveness and Innovation Framework Programme; Information and Communications Technologies - Policy Support Programme).

methods and integrate them in a complete supply chain of 3D digitisation to contribute a significant mass of 3D content.

3D-ICONS proposed to digitise a series of architectural and archaeological masterpieces of worldwide and European cultural significance and provide 3D models and related digital content to Europeana, with the objective of contributing to the critical mass of highly engaging content available to users.

The broad context of the 3D-ICONS is the 2020 strategy for Europe and the Digital Agenda for a flourishing digital economy, and the standards and increased interoperability needed to support Europeana as a multilingual common access point to millions of objects for all European citizens.

Europeana provides access to more than 14 million books, maps, recordings, photographs, archival documents, paintings and films from 1,500 cultural institutions across Europe. This content begins to illustrate the potential for Europeana to be used in schools and in other services. Yet there is great potential for continuing to extend and enhance the content base.[25] Europeana has itself set out objectives in its strategic plan in terms of both extending the content base and in seeking to cultivate new ways for its users to participate in their cultural heritage and enhance their experience. 3D-ICONS supports these policy objectives by allowing increased access to important cultural heritage sites through an effective use of digital technology. Through 3D models the general public can visit sites which may be in locations that are remote, fragile and in some cases difficult to understand. 3D-ICONS will both contribute to the expansion of Europeana's content base and also offer enhanced experiences for its users by bringing exciting and engaging content for archaeological monuments and historical buildings.

3D-ICONS relied on the achievements of the CARARE and other European projects,[26] which were already providing digital assets regarding European archaeology and architecture. It used the CARARE aggregation service and extended CARARE's coverage by digitising in 3D monuments and buildings and creating a large number of related digital items such as 3D models, images, texts, and possibly more.

[25] This was highlighted in the *New Renaissance* Report on Europeana in January 2011: ec.europa.eu/information_society/activities/digital_libraries/doc/refgroup/final_report_cds.pdf.

[26] www.carare.eu. CARARE is a best practice network designed to involve the network of heritage organisations, archaeological museums, research institutions and specialist digital archives in making the digital content that they hold available to Europeana. Other similar initiatives are 3D-COFORM: www.3d-coform.eu EuropeanaConnect: www.europeanaconnect.eu; Linked Heritage: www.linkedheritage.eu.

The content created by the project includes many of the most famous monuments and buildings in Europe. At the end of the project some 60 such iconic monuments and sites have been made available on Europeana, incorporating more than 4.000 3D models of architectural details and related objects, more than 17.000 high resolution images and 100 videos. All the selected masterpieces belong to UNESCO World Heritage Sites.

The process set up in the project involved technologies for both surveying and modelling (topographic surveying, 3D laser scanning, image-based modelling, etc.). A range of technology solutions were available for the processes and were well known and tested, and the equipment used was selected according to the features of the individual objects.[27]

CISA contributed to the creation of 3D content by acquiring and processing many statues and sarcophagi from the Archaeological Museum of Naples and some archaeological monuments in Naples (Roman Theatre, Termae of Carminiello ai Mannesi), Hercolaneum (Augusteum, Terrace of Nonio Balbo, Augustali Sacellum) and Pompeii (some tombs from the Necropolis of Porta Ercolano, some houses in Region VI). At the end of the project 120 3D models had been created out of the 578 digital resources provided to Europeana.[28]

The availability of 3D models of architecture or archaeological monuments within Europeana could show best practices and guidelines useful for new projects and 3D data collections.[29]

In the project CISA has been mainly involved in the aggregation and ingestion process. Furthermore CISA has contributed to updating the metadata schema adopted by the previous CARARE, extending it to support

[27] Different deliverables deal with the acquisition process (D.3.2), the post-processing phase (D.4.3) and the publication formats suitable for internet and Europeana. All the information will be summarises in the deliverable D.7.3 "Guidelines" ready at the end of the project (http://3dicons-project.eu/eng/Guidelines-Case-Studies).

[28] Data created by CISA are accessible at www.europeana.eu/portal/search.html?qt=false&rows=24&qf=DATA_PROVIDER%3A%22CISA+-Interdipartimental+Centre+for+Archaeology%22. Metadata are published under the terms of the Creative Commons CC0 1.0 Universal Public Domain Dedication and therefore can be reused by third parties without any restrictions. CISA contributed to the Deliverable D.2.1 (Digitisation planning report), D.4.2 (Interim Report on Metadata Creation) and D.6.1 (Report on metadata and thesauri). All deliverables are accessible at 3dicons-project.eu/eng/Resources.

[29] The 3D Models and all digital resources provided to Europeana are available at www.europeana.eu/portal/search.html?query=PROVIDER%3A+%223D+ICONS%22&rows=24. A portal has been developed by CETI for also having a geographical representation of the digital objects provided to Europeana: 3d_icons.ceti.gr/index.php/3d-icons. (Fig. 4). Further information about the resources is also available on this portal and a search engine has been implemented to access data easily.

provenance, transformation and London Charter[30] paradata required for the quality assurance of 3D models. One of the main aims of 3D-ICONS was to develop a metadata schema able to capture all the semantics present in the digitation process (*provenance*) and in understanding and interpreting data objects (*paradata*). Hopefully the new schema will encourage European institutions to adopt a clearer approach to the description of the features of cultural objects, the techniques and the methodologies chosen for digitisation and the motivation behind the creation of the digital object. Complete knowledge of the digital resource will allow a more efficient reuse of the archive increasing the usability of the resources available online. So it will be easier to compare models, their complexity, any eventual innovation in their creation and their reliability.

Newsletter di Archeologia

The last initiative launched by CISA, in terms of knowledge managing, is the online *Newsletter di Archeologia* review, whose intention is to present all the archaeological activities carried out by the archaeologists of the Università "L'Orientale". To facilitate dissemination and data sharing, all contributions are formatted in PDF and freely downloadable on the CISA website according to Open Access principles.[31] Six issues have been published since 2009[32] showing the methodological approach and preliminary results achieved by the scientific research activities of "L'Orientale". For CISA purposes in the field of the promotion of easy and widespread access to scientific data, the review has been indexed by the *Directory of Open Access Journal*.[33] CISA's *Newsletter di Archeologia* hosts contributions mainly concerning field activities carried out in Italy (Aveia, Cuma, Pontecagnano), Europe (Greece), Africa (Libya, Egypt, Ethiopia, Eritrea, Sudan), Asia (Iran, China, Uzbekistan, Turkmenistan) and the Arabian peninsula (Yemen, Saudi Arabia, Oman). It offers a wide panorama

[30] www.londoncharter.org.

[31] The journal adheres to *BOAI principles:* legacy.earlham.edu/~peters/fos/boaifaq.htm#openaccess Information about copyright statements is available at www.unior.it/ateneo/6241/1/copyright-statement.html.

[32] www.unior.it/ateneo/3632/1/newsletter-archeologia.html. The scientific director and editor-in-chief is Prof. Bruno Genito.

[33] http://doaj.org/toc/cbcc0ea33dac4102aca2de5020d08141

of research activities focusing on the interdisciplinary collaborations undertaken with other specialists in surveys and excavations.

Conclusions

This brief history highlights the challenges facing CISA and the work it carries out in testing new technologies and applying them to archaeological research and innovative management of the cultural heritage. The overview shows how all the different sectors of the Università "L'Orientale" have been actively involved in the various projects, explaining how some issues are relevant both for archaeology as a whole and for those areas rich in findings and history.

The experience gained by CISA since its constitution is basically grounded on the idea of making data openly available to public and private institutions. It has been possible to carry out this strategy thanks both to the development of new web programs and interfaces and to a new approach to the cultural heritage and its safeguarding, protection and diffusion in terms of the definition of metadata schemas, ontologies and other web technologies for data integration and interoperability.

In this narration the common element at the basis of each project is the archaeological data with their richness, history and content to be preserved. Each record is a piece of knowledge to be analysed, classified and rapidly made available to a wider scientific community.

The new challenge to be faced in the coming years will be the management of large datasets of archaeological data in order to extract new information and to create virtual environments to test alternative hypotheses and reconstructions dynamically. The outcomes so far achieved are encouraging and they appear likely to be useful in improving research into scientific results and communicating them among archaeologists and specialists.

Fig. 1 - Archeozone: Home Page

Fig. 2 - Aluka web-site showing a record provided by UNO's team

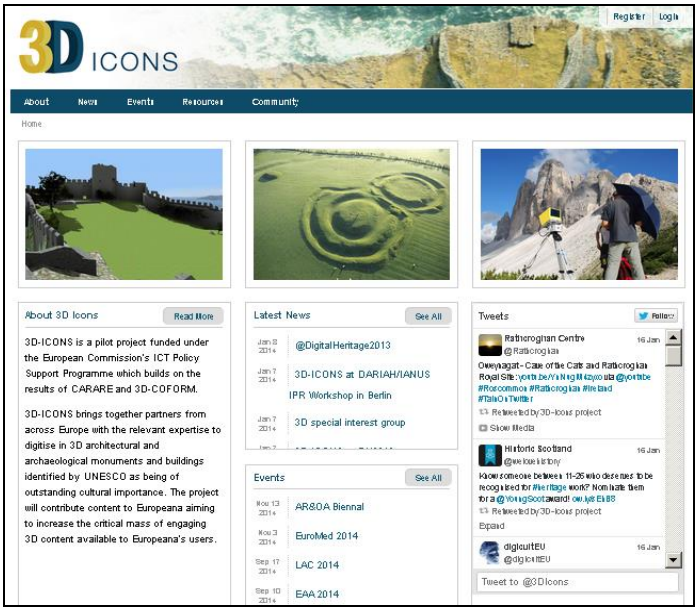

Fig. 3 - 3DICONS: Home Page

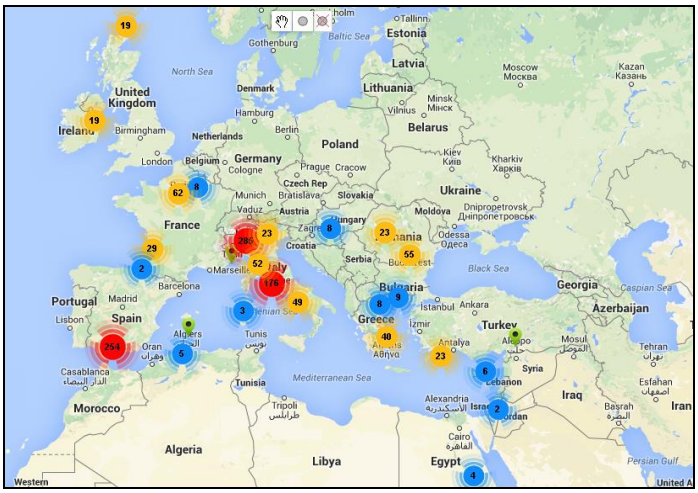

Fig. 4 - 3DICONS portal showing the geo-referenced distribution of 3D Models and digital objects (images, videos) provided to Europeana.