fRamework for safE, opEn, collaboratiVe And incLUsive digitisAtion and managemenT of cultural heritagE

Grant Agreement No 101132389

DELIVERABLE 2.1:

Cultural Items Identification & Digitisation

Work Package: 2

LEAD BENEFICIARY:

3D Research (3DR)

Delivery Date: 30.06.2025

Document Sheet

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Dissemination level

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Table of contents

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List of Figures

List of Tables

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Abbreviations

Abbreviations	Full name
CH	Cultural Heritage
WP	Work Package
D	Deliverable
T	Task
M	Month
3D	Three dimensional
VR	Virtual Reality
CHIs	Cultural Heritage Institutes
MB	Megabytes
SfM	Structure from Motion
GSD	Ground Sampling Distance
DAMS	Digital Asset Management Systems

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Publishable summary

This deliverable outlines the results of Task 2.1 "Cultural Items Identification & Digitisation" within the REEVALUATE project. The task aimed to identify and prepare a curated selection of cultural heritage artefacts—both existing digital resources and newly digitised content—for use in three pilot actions. Through collaboration with Cultural Heritage Institutions (CHIs) across Europe, the project mapped the availability, quality, and metadata standards of digital collections and supports small-scale digitisation where gaps were identified.

A common methodology allowed for the harmonised documentation of artefacts across three domains: fashion heritage (Pilot 1), Olympic and ethnographic culture (Pilot 2), and Roman archaeology (Pilot 3). Each pilot now possesses a tailored collection of cultural assets which will be used to demonstrate and validate the REEVALUATE framework.

The deliverable also includes an overview of digitisation technologies contributing to future integration for the final version of the same document.

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1 Introduction

The digitisation of cultural heritage artefacts represents a pivotal step in enabling Cultural Heritage Institutions (CHIs) to **make their collections more accessible, engaging, and sustainable**. Beyond simple documentation, digitisation offers CHIs the opportunity to expand public access, foster interdisciplinary research, and ensure the long-term preservation of tangible heritage. Over the past few decades, numerous CHIs have undertaken extensive digitisation initiatives, recognising the strategic value of producing **high-fidelity digital representations of physical artefacts** [1].

The advantages can be synthesised in these main aspects:

- It allows for seamless sharing and collaboration between researchers, museums, and institutions across the globe [2];
- It enhances the understanding of cultural items by integrating and aggregating heterogeneous data, including historical, artistic, material, and conservation-related information;
- It contributes to digital preservation strategies that safeguard artefacts against physical degradation or loss [3];
- It supports the creation of interactive tools, educational products, and immersive experiences for museums, galleries, and cultural organisations [4];
- It enables the reuse of digital objects in diverse contexts, such as virtual exhibitions, gaming environments, and creative industries [5].

In the context of the REEVALUATE Project, digitisation plays the role in providing the foundational content for testing and validating the project's framework and associated technological enablers. The three distinct Pilots selected for the validation of the framework represent different sectors of the cultural and creative ecosystem, ranging from fashion heritage to sports, ethnographic collections, and archaeological sites, as well as community-based engagement. These pilots are not only meant to demonstrate the flexibility and scalability of the REEVALUATE approach but also to highlight the diversity of artefacts, digitisation methods, and reuse scenarios.

For the development of the REEVALUATE Project, it is necessary to have access to digitised artefacts in order to create test cases for the framework and its enablers.

The expected outcome of this task is **a set of digitised CH artefacts per pilot**.

1.1 Purpose of the deliverable

This deliverable, D2.1, documents the activities carried out to identify and digitise cultural items in support of each Pilot. It includes a detailed overview of the artefacts selected, the digitisation approaches and technologies adopted, and the resulting digital assets made available for the subsequent development and testing of REEVALUATE's services. D2.1 is the first of two deliverables of task T2.1 "Cultural Items Identification & Digitisation". First of all, collections of the three Pilots have been identified, and then a selection of representative items has been preliminarily collected from each one.

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1.2 Relation with other deliverables

This deliverable is positioned inside the workflow of the REEVALUATE Project, benefiting from the contribution of the deliverable D1.3 “User needs & User scenarios”, which aims to integrate the outcomes of the previous two tasks to define a comprehensive set of user needs and usage scenarios for the REEVALUATE framework and its tools, but mainly from **D2.2** “Public Sensing Prioritization Enabler”, considering that Task focuses on the development of digital enabler to support the **democratised prioritisation of cultural artefacts for digitisation**, ensuring that people preferred objects are correctly used inside the digital experiences. Relevant contributions also come from **Task 4.1** “Pilot planning and validation methodology definition”, in which the Institutes better clarify the road to follow during the development.

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2 Identification of the involved Cultural Heritage Institutes and typology of artefacts

The identification of the Cultural Heritage Institutes involved in the project and the typology of artefacts to be used, represents the step for establishing the test cases required to validate the REEVALUATE framework and its associated enablers. Although large-scale digitisation is not within the project's scope, it is crucial to access a sufficient number of already digitised artefacts, or to perform targeted digitisation where necessary, to ensure the operational relevance of the pilots. The methodology employed for this task involved a preliminary mapping of the participating CHIs based on the themes and objectives of the three pilot actions. Each CHI was consulted to verify the availability of existing digitised artefacts, the formats in which they are stored (e.g., images, 3D models, texts, audio tracks, metadata), and their level of accessibility for reuse. Particular attention was given to the quality and richness of metadata, as these are fundamental for interoperability and contextualisation within the REEVALUATE ecosystem. Where existing collections were deemed insufficient to meet the pilot requirements—either in terms of quantity, relevance, or technical specifications—a small-scale digitisation activity was proposed. Overall, this identification process aimed to ensure that each pilot would have a curated set of artefacts suitable for demonstrating the potential of the REEVALUATE framework, while also offering a useful baseline to understand institutional digitisation practices, levels of readiness, and potential reuse scenarios in cultural and creative industries.

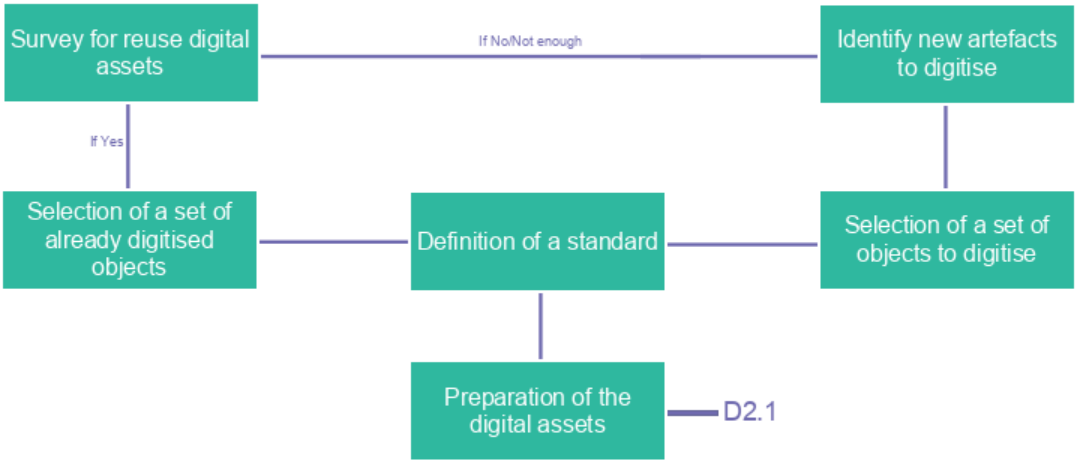

Figure 1. Workflow followed during T2.1 activities.

2.1 Cultural Heritage Institutes

2.1.1 Pilot 1 – Fashion Time Machine – MoMu

The First Pilot will involve the collaboration of EFHA, the MoMu – Fashion Museum Antwerp, NURO, and the company FibreMood. The goal is to validate REEVALUATE's comprehensive framework for managing digitised cultural heritage (CH) artefacts in the **Fashion and Gaming sectors**. The digitised artefacts will be provided to NURO to develop Fashion Time Machine, a mobile game that lets players design and customise virtual outfits using elements from the digitised collections, allowing users to mix and match clothing and accessories. The pilot began with a survey of the collection of fashion heritage artefacts from MoMu, including garments, accessories, and sketches. The ModeMuseum in Antwerp stands as Belgium's premier institution dedicated to fashion, renowned for its immersive exhibitions and a vast collection that emphasises both historical garments and contemporary design. This Cultural Heritage Institute houses a

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substantial collection of Western European costumes, textiles, garments, accessories and tools, including over 40.000 objects from the 18th to early 20th centuries. Also, a separate collection of 2.000 objects (the Study Collection) are **already digitised and described** with images and metadata, are accessible through a built-in house online catalogue (using the open-source CMS Omeka-S) that allows users to search and visualise historical and contemporary dresses and accessories using filters and classes by period, by materials and techniques, and by text. This fully digitised and easily accessible collection will be used for the ReEvaluate Project. MoMu will share the digitised artefacts with FibreMood, a company that publishes a DIY magazine for creatives who love to sew their own garments and helps sewers select fabrics and customise patterns. FibreMood will create the necessary assets for its community (patterns, work descriptions, instructive videos, etc.) to enable its users to recreate garments from MoMu's Study collection and make the artefacts and related metadata available to its users, enabling them to recreate garments while understanding their historical and cultural context.

Figure 2. Example of MoMu digital collection. Source: https://heron.libis.be/momu/s/studiecollectie/page/welcome.

2.1.2 Pilot 2 – From Museums to Screens – Olympic Museum of Thessaloniki, Ethnologisches Museum of Berlin

The second REEVALUATE pilot focuses on addressing the challenges of digitising artefacts and ensuring their sustainable management within the **Creative Industries and Advertising sectors**. It involves a collaboration between FFP, the Olympic Museum of Thessaloniki, and the Ethnologisches Museum of Berlin (SPK). The pilot will centre around an **immersive exhibition** titled *The Olympic Experience*, hosted at the Olympic Museum in Thessaloniki. The exhibition will explore the Olympic Games from antiquity to the present day through five thematic rooms, each featuring a dedicated project. Digitised artefacts from both the Olympic Museum and the ethnomusicology collection of the Ethnologisches Museum (SPK) will be showcased through multimedia installations co-developed by pilot partners. Some of these artefacts will be digitised specifically as part of the REEVALUATE project. While animations and 2D/3D graphic effects will involve objects coming from the Olympic Museum of Thessaloniki collection, the immersive audio contents will be produced using digital audio tracks of the Ethnologisches Museum of Berlin (SPK).

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The Olympic Museum of Thessaloniki, uniquely recognised by the International Olympic Committee, serves as Greece's central institution for preserving and promoting Olympic heritage. Established in 1998 and renamed in 2008, the museum is situated near Kaftanzoglio National Stadium and the Aristotle University of Thessaloniki. The museum's extensive collection encompasses artifacts from both the ancient and modern Olympic Games, including the permanent exhibition on Olympic Games, which traces the evolution of the Olympics from antiquity to the present, covering Summer, Winter, and Youth Games, and features memorabilia such as medals, torches, athletic equipment, and personal items from Greek Olympians.

The Ethnologisches Museum in Berlin is one of the world's most significant institutions dedicated to non-European cultural heritage. Founded in 1873, it now resides in the Humboldt Forum, housing a vast collection of artefacts and documents that reflect the diversity and richness of global cultures. The museum's extensive holdings include ethnographic, archaeological, and cultural-historical objects from Africa, Asia, the Americas, Australia, and the Pacific Islands. These are complemented by substantial archives of photographs, films, sound recordings, and written documents, making it one of the most comprehensive collections of its kind. The Museum houses one of the world's most significant ethnomusicological sound archives. These recordings capture music and speech from various cultures.

The potential link between these two museums lies in their shared goal of preserving and disseminating cultural heritage through storytelling. By collaborating, they could create joint audio projects that explore the intersection of sports and culture across different societies.

Figure 3. Exhibit room of the Olympic Museum of Thessaloniki.

2.1.3 Pilot 3 – From Public Sensing to Virtual Tours – Aquileia archaeological area

The third Pilot of the REEVALUATE project is centred on the **archaeological site of Aquileia**, with the goal of engaging the local community in the selection and evaluation of cultural assets to be featured in an innovative **Virtual Tour**. This participatory approach not only empowers local stakeholders but also ensures that the resulting digital narratives reflect the values and interests of the communities most closely connected to the site. At the heart of this initiative is the Fondazione Aquileia, a key institution responsible

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for the conservation, management, and promotion of the site's rich archaeological heritage. Designated as a UNESCO World Heritage Site in 1998, Aquileia holds exceptional historical significance due to its vast repository of Roman-period artefacts, many of which remain underground and remarkably well-preserved. The town is also renowned for its early Christian basilicas, mosaics, and religious architecture, which stand as a testament to its importance in the early development of Christianity in Europe. Founded in 181 BC as a Roman colony, Aquileia played a crucial role as a strategic military outpost, guarding the northeastern borders of the Roman Empire. Its favourable position near the Adriatic Sea also allowed it to flourish as a major commercial hub, facilitating the movement of goods, people, and ideas across the empire. Over time, Aquileia evolved into a vibrant urban centre, boasting monumental public buildings, roads, forum, and private domus—many of which form the core of ongoing archaeological research and preservation efforts. Today, Aquileia is recognised as one of the most significant archaeological sites in Italy and Europe, offering a unique window into the urban, commercial, and religious life of the Roman Empire. Despite centuries of change, much of its ancient urban layout remains intact beneath the modern landscape, making it a living archive of Roman civilisation. By combining digital innovation with community heritage, the Aquileia pilot aspires to create a model for participatory heritage digitisation, where technology and tradition intersect to preserve and promote the stories of the past in ways that are meaningful for the present and future.

Figure 4. Part of Aquileia archaeological area.

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2.2 Heritage collections of CHIs

To initiate the process of identifying the CHIs and to establish a comprehensive overview of the available digital cultural assets, a dedicated questionnaire was designed and distributed to all CHI partners engaged in the pilot actions. The primary objective of this instrument was to collect structured, standardised information that would enable the project team to map the current availability, typology, and accessibility of digitised artefacts and to anticipate the needs for further digitisation where gaps were identified.

2.2.1 Structure of the questionnaire for identifying the heritage collections

The questionnaire was developed to support a systematic data collection process, ensuring consistency across all pilot sites. It was designed to be user-friendly, allowing pilot leaders to complete it independently or in collaboration with technical partners, particularly the tool developers, where technical clarification or support was needed. The document is divided into two main sections, spread across two pages, each aimed at gathering specific categories of information (Table 1).

Page 1: Section 1 – Already Digitised Objects

This section focuses on identifying digital objects already in the possession of the CHIs, which are available and potentially usable within the pilot use case. Respondents are asked to provide general information about the scope and content of their digitised collections, including:

- The estimated number of digitised artefacts available in the collections;
- The types of objects already digitised;
- The formats used for storing and related weight (e.g., 2D images, 3D models, video/audio recordings, metadata standards, textual documents);
- Details on copyright and usage rights associated with the digital objects;
- Platforms or repositories where these collections are currently accessible;

This section is critical to understanding the state of readiness of the partner CHIs and to determining whether the existing assets can satisfy the technical and thematic needs.

Page 1: Section 2 – Objects to Be Digitised

This section investigates the potential need for new digitisation efforts during the project. Partners are asked to briefly identify artefacts that are not yet digitised but could be relevant for the pilot use case and aligned with the overall project goals. For each identified object or group of objects, respondents are invited to describe:

- The type and estimated number of artefacts;
- The significance or relevance of the objects for the pilot theme;
- Conservation or handling constraints;
- Existence of documentation, such as descriptions, metadata, information related to objects;
- Preferred or recommended digitisation methods and representation for the pilot development;
- Any legal, ethical, or logistical considerations that may affect access or reuse;

This section allows the REEVALUATE consortium to anticipate digitisation needs, plan the necessary resources, and align technical workflows accordingly.

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Page 2: Digital Objects – Detailed Examples

The second page of the questionnaire is dedicated to collecting detailed data on 5 specific and representative objects, digitised or to be digitised, that the CHIs intend to include in their respective pilot use cases. This granular level of documentation is crucial for facilitating the integration of these assets into the REEVALUATE framework, ensuring metadata alignment, verifying legal clearance for reuse, and estimating resources to produce. For each of the selected objects, CHIs are asked to provide the following information:

- Object title and unique identifier;
- Brief description of the artefact;
- Type and classification (called domain in the sequent);
- Digitisation format(s), resolution/quality, storage weight;
- Metadata available;
- Rights statement or usage license;
- Existing access link (if the item is already published online);

The objective of this data collection step is to create a representative sample of usable digital assets per pilot, which can support testing, integration, and demonstration of the REEVALUATE tools and enablers.

Table 1. Structure of the questionnaire submitted to CHIs.

SECTION 1 – ALREADY DIGITISED OBJECTS	
Type of Request	***Suggestion***
Specify the type and number of digital objects that will be included in the pilot use case	*Provide quantities for each type* *(n. 5 3D models of statues, n. 3 videos, n. 4 high-resolution images, n. 2 audio files)*
Specify the file formats for each type of digital object listed	*Images: JPEG, PNG, TIFF* *Audio files: MP3, WAV* *Video files: MP4, AVI* *3D models: OBJ, STL* *doc: PDF, DOCX, SVG, DWG* *other*
For each digital object to be included in the pilot use case, is there a description of its corresponding physical item or additional content (either as an accompanying file or included within the object)?	*Specify the format (text, graphics, audio, video, etc.)*
List the types of metadata related to each digitised artefact that will be used in the pilot use case.	*Specifically, what types of information are captured within this metadata, such as creator details, date of creation, technical specifications, descriptive tags, and any other relevant data*
Provide an estimate of the total size (in MB) of the digital items that will be included in the pilot use case.	*250 MB total, 5 MB per file*

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What intellectual property (IP) rights management and usage/sharing policies does the pilot leader currently apply to their digital objects, or intend to apply in the future?	*Copyright* *Creative Commons Licenses* *Watermarking* *DRM (Digital Rights Management)* *Other (please specify)*
How does the pilot leader intend or plan to share/make available digital objects?	*Provide details on the platforms, protocols, or channels used for sharing, including any restrictions or access controls implemented*
Is data stored/processed on your machines or externally (cloud, hoster)?	*If yes, please specify the external repository/service*
Are your digitised artefacts and metadata externally accessible?	*If yes, please specify the service (Institute website, dedicated platform, shared database)*
If digital objects are stored in external repositories, how does the pilot leader plan to provide access?	*Specify any technical details related to accessing data stored externally, including APIs, protocols, limitations, etc.*
Is the APIs publicity available?	*If yes, please specify how*
Are access rights handling specific to your institutions, or can it be integrated into a wider REEVALUATE "single sign-on"?	*For example, by logging in with Google, Apple, Facebook or Microsoft credentials*
Would you be (organisationally/legally) able to provide content access to the project (for the pilots) or should the information above be considered for conceptual use (i.e. architecture) only?	*Yes/No*
SECTION 2 – OBJECTS TO BE DIGITISED	
How many new physical objects would you provide for the case study of the Pilot (if the existing ones don't fulfil the requirements)?	*n. 5-10 new artefacts*
Specify the types of objects you would provide for the case study	*painting, sculpture, textile, document/manuscript, other*
What file type is expected for the new digital objects?	*Images, audio files, video files, 3D models, text documents, and others*
For each physical item intended for digitisation in the pilot use case, is there a description (as an accompanying file)?	*This could include relevant information such as the object's provenance, historical significance, physical condition, and any other pertinent details.*
Provide information about the type of metadata that you plan to create for the new digital objects	*creator information, date of creation, technical specifications, descriptions*
What intellectual property (IP) rights management and usage/sharing policies does the pilot leader intend to apply?	*Copyright* *Creative Commons Licenses* *Watermarking* *Other (please specify)*
How does the Pilot Leader plan to share/make available the new digital objects?	*Provide details on the platforms, protocols, or channels used for sharing, including any restrictions or access controls implemented*

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2.2.2 Data collected from each Pilot

The responses to the questionnaire will form the core reference for the identification of digital content across the pilots and will directly support the implementation of other tasks in the REEVALUATE work plan, particularly those focused on artefact reuse, contextualisation, and public engagement. Furthermore, the collected data will guide technical decisions on digitising technologies, interoperability, metadata mapping, content management, and validation of usage scenarios. This effort ensures that the selection and use of artefacts in REEVALUATE are grounded in a clear understanding of existing resources, institutional constraints, and strategic relevance.

2.2.2.1 Pilot 1 – Fashion Time Machine

The Study Collection managed by one of the CHI partners comprises approximately **2.000 total objects**, from which a smaller subset will be selected for the Pilot development. These selected objects are **already digitised and accompanied by relevant descriptive content and metadata**. The digital files primarily consist of high-resolution images (JPG) and 2D patterns in scalable vector formats (SVG) or PDF, ensuring both visual documentation and potential for reuse in creative and educational contexts. Each digitised artefact is accompanied by essential metadata, including but not limited to object name, creator (if known), date of creation, materials and techniques, descriptive and contextual content. Some metadata elements also come from a thesaurus (e.g. object name, material, technique), linked to 2 multilingual Linked Open Data sources (Europeana Fashion Thesaurus and Art (http://thesaurus.europeanafashion.eu/) & Architecture Thesaurus (https://www.getty.edu/research/tools/vocabularies/aat/)). This level of documentation ensures that the objects can be effectively integrated within the REEVALUATE framework and reused for the Pilot execution. Also, a set of representative objects has been shared by MoMu and stored on the NextCloud shared project folder.

Table 2. Collection of Pilot 1 CHI.

SECTION 1 – ALREADY DIGITISED OBJECTS	
Specify type and number of digital objects that will be included in the pilot use case	*Study Collection Mode Museum Antwerpen consists of approximately 2.000 objects. A selection of 5/10 objects will be part of the pilot.*
Specify the file formats for each type of digital object listed	*jpg (images of the objects); svg (digitised 2D patterns in an open source, vectorised file format), PDF (2d patterns)*
For each digital object to be included in the pilot use case, is there a description of its corresponding physical item or additional content (either as an accompanying file or included within the object)?	*image & graphic*
List the types of metadata related to each digitised artefact that will be used in the pilot use case.	*Object name; creator (if available); date of creation; medium (material/technique); description; context (if available); holding institution; ID (inventory number); ARK-identifier; location where the object is stored.*

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Provide an estimate of the total size (in MB) of the digital items that will be included in the pilot use case.	*Depends on the pilot scope. But what is currently available for the selected objects (5/10) would be less than 100 MB for the jpgs & SVGs*
What intellectual property (IP) rights management and usage/sharing policies does the pilot leader currently apply to their digital objects, or intend to apply in the future?	*share the content under CC BY license (attributing MoMu as holding institution & name of the photographer), if no 3rd rights party rights apply*
How does the pilot leader intend or plan to share/make available digital objects?	*we would prefer to share everything with a CC BY license*
Is data stored/processed on your machines or externally (cloud, hoster)?	*cloud storage (digital ocean server)*
Are your digitised artefacts and metadata externally accessible?	*yes*
If digital objects are stored in external repositories, how does the pilot leader plan to provide access?	*through the API of Omeka-S (our Open Source CMS in which the Study Collection database has been created)*
Is the APIs publicity available?	*Yes*
Are access rights handling specific to your institutions, or can it be integrated into a wider REEVALUATE "single sign-on"?	-
Would you be (organisationally/legally) able to provide content access to the project (for the pilots) or should the information above be considered for conceptual use (i.e. architecture) only?	*access to the content can be provided*

Table 3. Sample of already digitised object from the CHI.

SECTION 3 – PROVIDE AN EXAMPLE OF ALREADY DIGITISED OBJECTS			
Object Name	*Jacket*	*Pattern of jacket*	*Corsage*
Brief Description	*Short jacket, perhaps for bed, in beige and pink silk charmeuse, entirely quilted with large checks. V-neckline. Straight gathered sleeves that curve slightly at the wrist. It closes in the centre with a large button (missing but described in the original sheet) and a loop. Lined with blue silk muslin*	*Pattern made in the context of the MoMu Pattern-a-thons*	*Corsage, yak in blue taffeta with zigzag motifs formed by float motifs of a white warp; model with square neckline, elbow-length sleeves and long lap panels; closes with hooks and eyes; lining in blue striped linen*
Object Type	*Image*	*Drawing (pattern)*	*Image*

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Format	*jpg (low-res screen resolution) also TIFF and hi-res image is available*	*Svg*	*jpg (low-res screen resolution) also TIFF and hi-res image is available*
Size (MB)	*948 kB*	*15 kB*	*450 kB*
Embedded Metadata	*yes*	*No*	*yes*
Metadata	*Link provided*	*Link provided*	*Link provided*
Additional Content	*image are stored in our DAMS; different resolutions are available, see link for different metadata properties*	(see ARK link for metadata properties)	*image are stored in our DAMS; different resolutions are available, see link for different metadata properties*
Link to the Object/to the Folder	*provided*	*provided*	*provided*

2.2.2.2 Pilot 2 – From Museums to Screens

The **already digitised collection** available for the pilot includes a diverse range of materials such as images, historical letters, and audio recordings. These digital assets are provided in various standard formats, including JPEG, PNG, TIFF, PDF, DOCX, and MP3, supporting both visual and auditory engagement. Each object is accompanied by associated content, ensuring contextualisation. The metadata structure covers a broad set of descriptors, including the object's category, theme, creator, provenance, physical and technical characteristics, date and place of creation. The estimated total size of this collection is between 300 and 500 MB. These items are currently accessible via the institution's official website and through wider dissemination platforms such as Europeana and SearchCulture. The **existing collection does not fully meet the needs** of the REEVALUATE pilot scenario, so the CHI partner is prepared to digitise a new set of physical objects. This includes approximately 12 artefacts suitable for 3D modelling (e.g., medals, sporting equipment) and letters. The expected output includes both 3D models and high-quality 2D images.

Table 4. Collection of Pilot 2 CHIs.

SECTION 1 – ALREADY DIGITISED OBJECTS	
Specify type and number of digital objects that will be included in the pilot use case	*high resolution images, letters etc, audio tracks*
Specify the file formats for each type of digital object listed	*JPEG, PNG, TIFF, PDF, DOCX, MP3*
For each digital object to be included in the pilot use case, is there a description of its corresponding physical item or additional content (either as an accompanying file or included within the object)?	*text, photo, music score*

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List the types of metadata related to each digitised artefact that will be used in the pilot use case.	*description, category, theme, creator, object's provenance, date and place of creation, technical specifications, dimensions, material, physical condition*
Provide an estimate of the total size (in MB) of the digital items that will be included in the pilot case.	*300-500 MB total*
What intellectual property (IP) rights management and usage/sharing policies does the pilot leader currently apply to their digital objects, or intend to apply in the future?	*Creative non commercial License*
How does the pilot leader intend or plan to share/make available digital objects?	*Digital object are now available both on our official website and on national and global platforms we are included (SearchCulture, Europeana). Also via this project they will be presented to the public through an exhibition at the museum and the publication of a video-trailer of the pilot.*
Is data stored/processed on your machines or externally (cloud, hoster)?	*Data are stored and processed on our own database*
Are your digitised artefacts and metadata externally accessible?	*Our digitized artefacts and metadata are accessible in public through our official website and platforms such as Europeana and SearchCulture.*
If digital objects are stored in external repositories, how does the pilot leader plan to provide access?	*There is no intend to store our data in external repositories*
Is the APIs publicity available?	*No, APIs publicity is not available*
Are access rights handling specific to your institutions, or can it be integrated into a wider REEVALUATE "single sign-on"?	*Access rights are handing specific to our institution*
Would you be (organisationally/legally) able to provide content access to the project (for the pilots) or should the information above be considered for conceptual use (i.e. architecture) only?	*Information is exclusively considered for conceptional use*
SECTION 2 – OBJECTS TO BE DIGITISED	
How many new physical objects would you provide for the case study of the Pilot (if the existing ones don't fulfil the requirements)?	*12 3D objects (medal, book, cup, bike, clubs, ball, gymnastics band etc), 50 high-resolution images*
Specify the types of objects you would provide for the case study	*12 3D objects (medal, book, cup, bike, clubs, ball, gymnastics band etc), 50 high photographs and letters*
What file type is expected for the new digital objects?	*3D models and images*

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For each physical item intended for digitisation in the pilot use case, is there a description (as an accompanying file)?	*description, category, theme, creator, object's provenance, date and place of creation, dimensions, material, physical condition and authoritative information through scientific research*
Provide information about the type of metadata that you plan to create for the new digital objects	*description, category, theme, creator, object's provenance, date and place of creation, dimensions, material, physical condition and authoritative information through scientific research*
What intellectual property (IP) rights management and usage/sharing policies does the pilot leader intend to apply?	*Creative non-commercial License*
How does the Pilot Leader plan to share/make available the new digital objects?	*Via this project they will be presented to the public through an exhibition at the museum and the publication of a video-trailer of the pilot*

Table 5. Sample of already digitised object from the CHIs.

SECTION 3 – PROVIDE AN EXAMPLE OF ALREADY DIGITISED OBJECTS		
Object Name	*Excerpt of the telegram from Vikelas Dimitrios to the Panhellenic Gymnastic Association*	*Audio track*
Brief Description	*Excerpt of the telegram from Vikelas Dimitrios to the Panhellenic Gymnastic Association announcing that the Paris conference expresses the hope that the celebration of the first International Olympic Games will be held in Athens in 1896.*	*Vocal and instrumental track coming from the Olympic Games traditions. Music instruments and songs differentiated by participant Nations.*
Object Type	*Image*	*Audio*
Format	*JPG*	*MP3*
Size (MB)	*27 kB*	*3.7 MB*
Embedded Metadata	*yes*	*no*
Metadata	*description, category, theme, creator, object's provenance, date and place of creation, technical specifications, dimensions, material, physical condition*	*description, category, theme, creator, object's provenance, date and place of creation, historical context*
Additional Content	-	-
Link to the Object/to the Folder	*provided*	*provided*

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2.2.2.3 *Pilot 3 – From Public Sensing to Virtual Tours*

For this pilot, a collection of **high-resolution videos** has been made available to contextualise the needs. These videos focus on the 3D reconstruction of archaeological areas within the UNESCO World Heritage Site of Aquileia. While only the final video outputs are available (not the original 3D model source files), these assets provide valuable audiovisual material that can support the communication and dissemination components of the pilot. Considering that no digital materials are available for the Pilot execution, **the CHI foresees the digitisation of a set of artefacts associated with the "Domus di Tito Macro"** (Titus Macer's House), one of the largest Roman domestic complexes discovered in northern Italy. The selected objects for digitisation include archaeological finds with provenance from the Domus, currently exposed inside the same area and in the National Archaeological Museum. The items will also be selected from public sensing for their representativeness, their connection to the archaeological context, and their relevance for the development of a virtual experience of the Domus. **The expected output format is 3D models**, suitable for immersive digital presentation. For each object, a descriptive text will be compiled, including provenance, historical context, physical materials, intended function, and comparisons with similar artefacts. Photographs and extracted images from the existing video material may also be provided to support interpretation. Through the combination of storytelling and 3D content creation, the Aquileia pilot contributes not only to the technical testing of the REEVALUATE framework but also to the broader goal of engaging the public with the hidden richness of Roman heritage preserved within and beneath this historic site.

Table 6. Collection of Pilot 3 CHI.

SECTION 1 – ALREADY DIGITISED OBJECTS	
Specify type and number of digital objects that will be included in the pilot use case	*We are able to provide 8 high-resolution videos focused on the 3D reconstruction of the archaeological areas of the UNESCO site of Aquileia. We don't have the source file, just the final output (.mp4 format).*
Specify the file formats for each type of digital object listed	*.mp4*
For each digital object to be included in the pilot use case, is there a description of its corresponding physical item or additional content (either as an accompanying file or included within the object)?	-
List the types of metadata related to each digitised artefact that will be used in the pilot use case.	-
Provide an estimate of the total size (in MB) of the digital items that will be included in the pilot use case.	*around 230 MB per each video*
What intellectual property (IP) rights management and usage/sharing policies does the pilot leader	*Current situation: copyright.*

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currently apply to their digital objects, or intend to apply in the future?	*For the future: we need to deepen the possible new policies*
How does the pilot leader intend or plan to share/make available digital objects?	*The videos are available on the website* *If necessary, we can send them via WeTransfer*
Is data stored/processed on your machines or externally (cloud, hoster)?	*website, social media (YouTube channel @FondazioneAquileia) and internal server*
Are your digitised artefacts and metadata externally accessible?	-
If digital objects are stored in external repositories, how does the pilot leader plan to provide access?	-
Is the APIs publicity available?	-
Are access rights handling specific to your institutions, or can it be integrated into a wider REEVALUATE "single sign-on"?	-
Would you be (organisationally/legally) able to provide content access to the project (for the pilots) or should the information above be considered for conceptual use (i.e. architecture) only?	-
SECTION 2 – OBJECTS TO BE DIGITISED	
How many new physical objects would you provide for the case study of the Pilot (if the existing ones don't fulfil the requirements)?	*In the context of the archaeological site "Domus di Tito Macro / Titus Macer's House" (please find here more information https://shorturl.at/Sauvl), we would like to work on 5 "objects" -that could be the basis for a broader virtual tour of the Domus.*
Specify the types of objects you would provide for the case study	*1_stone weight (found in the premises of the Domus and currently preserved in the National Archaeological Museum of Aquileia)* *2_stone brick oven (still located within the Domus)* *3_stone well (still located within the Domus)* *4_ancient coins (found in the premises of the Domus and currently preserved in the National Archaeological Museum of Aquileia)* *5_mosaic (polychrome mosaic with fawn and dog, still located within the Domus) > if possible, considering that it is developed on a horizontal dimension*
What file type is expected for the new digital objects?	*3D models for a virtual tour*
For each physical item intended for digitisation in the pilot use case, is there a description (as an accompanying file)?	*for each item, it could be provided a descriptive text containing the following information: provenance, description of historical relevance, materials, aim, comparison with similar "objects" of other areas outside*

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	Aquileia. Moreover, a picture of the real "object" and/or 3D reconstruction (taken from the already available videos) can be provided.
Provide information about the type of metadata that you plan to create for the new digital objects	*historical period, weight (when possible eg. stone weight)*
What intellectual property (IP) rights management and usage/sharing policies does the pilot leader intend to apply?	*Copyright*
How does the Pilot Leader plan to share/make available the new digital objects?	*WeTransfer*
Note	*The "Domus of Tito Macro", one of the largest dwellings of Roman times among those found in northern Italy, covers an area of 1.500 square meters and is unique in Europe.*

2.3 Results of the classification of CHIs collections

Following the collection and analysis of questionnaire responses from the participating Pilots, a general classification of the identified cultural heritage artefacts has been developed. This classification highlights the needs for each Pilot, the type of objects, the digital formats used, and the metadata standards applied. While each Pilot is characterised by unique thematic focuses and institutional practices, **shared methodological principles ensure alignment with the overarching goals** of the REEVALUATE project. Each Pilot has selected artefacts representative of its institutional and thematic context: Pilot 1 focuses on historical and contemporary dresses and clothes, with a specific emphasis on high-resolution images and 2D patterns, Pilot 2 centres on culture content from the Olympic Games including a differentiated range of media, Pilot 3 deals with archaeological finds selected to support immersive storytelling and virtual exploration.

Table 7. General classification of the three Pilots.

	Pilot 1	Pilot 2	Pilot 3
Type of objects	*Dresses, clothes and digital patterns*	*Museum objects and cultural contents*	*Archaeological finds*
Domain	*Historical Fashion Heritage*	*Cultures in Olympic Games*	*Archaeology*
Collection	*Already digitised*	*Already digitised and to be digitised*	*To be digitised*
Final Format File	*Images and patterns*	*Images, 3D models, audio tracks*	*3D models, images*
Metadata associated	*Creator, material, ID, location, description, technical spec.*	*Description, material, category, technical spec., condition, date*	*Material, historical context, provenance, comparison with similar objects, aim*

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3 Identification of the CH artefacts

Following the submission and evaluation of the questionnaires, **n. 5 objects from each pilot were collected** and stored in the shared project working platform. Each object comes with a representative image and a description or a metadata profile provided by the CHIs and rearranged in a spreadsheet. It was possible to **systematically group and analyse the information** related to the cultural artefacts that each partner intended to share for the REEVALUATE project. The shared objects, though differing in typology, format, and thematic focus, were analysed across several dimensions: type of media, available metadata, available descriptions and categorisation, domain, and intended use within the project. The artefacts span various formats such as high-resolution and low-resolution images, vector graphics, audio tracks, and video reconstructions. This multimedia diversity enables the project to address both tangible and intangible heritage dimensions. In the figure below, the collected representative set of objects is shown. In Figure 5 and Figure 6 show objects from Pilot 1. Figure 7, Figure 8, and Figure 9 show objects from Pilot 2. In Figure 10, Figure 11 and Figure 12 is possible to see artefacts from Pilot 3. **Each image (or object) is accompanied by a description and the general information** about the related cultural asset.

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Resource ID	Access	Contributed By						
71231	Open	Stany Dederen						
GENERAL								
Publisher	**Category**	**Source Material Type**	**Inventory**	**Creator**	**Artwork Date**	**External note**	**Color or b/w**	**Rating**
MOMU	MOMU, MOMU/Studiecollectie, MOMU/Studiecollectie/Objectfoto	Original digital capture of a real life scene	ST659/1AB	Stany Dederen	1948 / 1957	Voor meer info en beeldmateriaal, surf naar https://commons.wikimedia.org/wiki/File:Mantelpak_(ST659_1AB_01)_-_Kostuum_-_MoMu_Antwerp.jpg	Color	4
COPYRIGHT								
License	**Copyright Owner**	**Copyright notice**	**Credit**					
CC BY	Stany Dederen	© Stany Dederen	© Collectie Modemuseum Antwerpen, schenking Frieda Dauphin-Verhees, foto Stany Dederen					
TECHNICAL DATA								
Creator tool	**File format**	**File size**	**Original time & date**	**Original filename**	**MD5 checksum**	**Camera make/model**		
Capture One 10 Macintosh	TIFF at different resolution	8,5 MB 2401 x 3543 px (maximum)	05 December 17 @ 16:16	04122017416 19.tif	c1b3421791b16ae3fb3bdc807e07789d	Credo 40		
TMS INFO								
TMS object ID	**TMS object name**	**TMS Description**	**TMS dated**	**TMS medium**	**TMS classification**			
54636	mantelpak / jacket	Black coat suit. A. Jacket in black wool, closing with plastic buttons in the centre front, with accents of black fabric with interwoven block pattern. Made of this are the small shawl collar, pocket turn-ups, sleeve cuffs and two flaps at neckline level (optical ends of a scarf or tie). The slanted side pockets are partially incorporated into a seam and emphasise the shape of the hips. No lining. B. Black wool calf-length skirt with waistband, at the back at the bottom there are two pleats turned inwards. Closes with press-studs.	1948-1957	wool; plastic; synthetic fibre; fabric; metal				
REF LINK								
https://heron.libis.be/momu/s/studiecollectie/item/mjdft0	https://museumstichting.resourcespace.com/pages/view.php?ref=71231&k=6dfbbb4b8f							
EXTRA INFO								
current permanent location	**department**							
LZ.UNIT.90	Studiecollectie							

Figure 5. Object ST659-1AB. Source: Studiecollectie website – Pilot 1 (http://data.momu.be/ark:34546/mjdft0).

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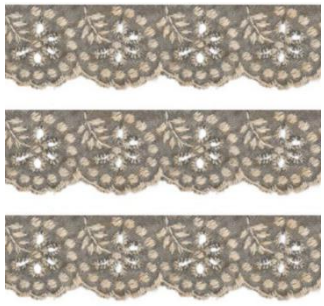

Resource ID	Access	Contributed By						
73730	Open	Stany Dederen						
GENERAL								
Publisher	**Category**	**Source Material Type**	**Inventory**	**Creator**	**Artwork Date**	**External note**	**Color or b/w**	**Rating**
MOMU	MOMU, MOMU/Studiecollectie, MOMU/Studiecollectie/Objectfoto	Original digital capture of a real life scene	ST22041	Stany Dederen	1900		Color	
COPYRIGHT								
License	**Copyright Owner**	**Copyright notice**	**Credit**					
CC BY	Stany Dederen	© Stany Dederen						
TECHNICAL DATA								
Creator tool	**File format**	**File size**	**Original time & date**	**Original filename**	**MD5 checksum**	**Camera make/model**		
	JPEG							
TMS INFO								
TMS object ID	**TMS object name**	**TMS Description**	**TMS dated**	**TMS medium**	**TMS classification**	**NOTE**		
59572	apron	Child's apron, or overgown, for a (school-aged) child of about seven years, of grey-white cotton ticking. Round neckline with wide, square flat collar trimmed with a border of machine embroidery anglaise. Wrinkled inset long sleeves tapering towards the wrist, trimmed with a border of broderie anglaise. Three wide flat pleats at centre front. Two patch pockets at hip height, trimmed at the top with broderie anglaise and tapering to a point at the bottom. Trimmed along the entire lower edge with a strip of broderie anglaise. Square collar at the back. A wide flat pleat along either side of opening at centre back. Closes centre back by one white mother-of-pearl button at neck and another slightly below, and tied at side with two wide strips of grey-white ticking. height: 62 cm shoulder width: 29 cm			cotton, plattbinding, tijlk broderie anglaise, pearlised		fragile		
REF LINK								
https://heron.libis.be/momu/s/studiecollectie/item/m3txft								
EXTRA INFO								
current permanent location	**department**							
LZ.UNIT.39	Studiecollectie							

Figure 6. Object ST2241. Source: Studiecollectie website – Pilot 1 (http://data.momu.be/ark:34546/m3txft).

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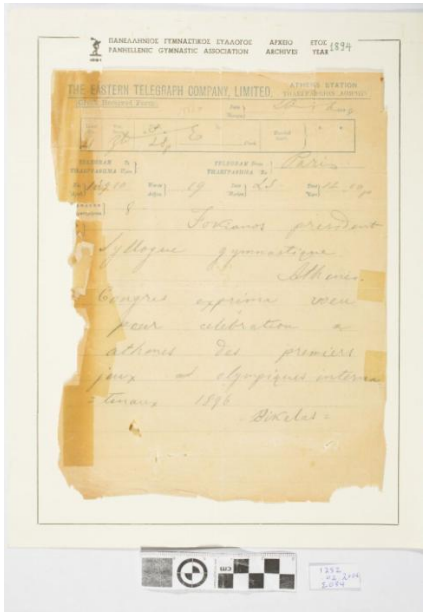

ID No.	Prev numbers	Category	Description	Permanent Position	Material	Work Collection	Persons	Place	Chronology	Measurement	Status
OM-00000017	1252 Ξ084Αφi έωςiii	LETTER	Clipping of Vikelas Dimitrios' telegram to the Panhellenic Gymnastic Association announcing that the Paris Congress expresses the hope that the celebration of the first International Olympic Games will take place in Athens in 1896. The telegram was handwritten and sent from Paris to Athens on June 23, 1894.	IT BELONGS TO THE COLLECTION OF PANELLINIOS	Paper, Cardboard	Objects	Creator: Dimitrios Vikelas, Donor: PANELLINIOS GYMNASTIKOS SYLLOGOS	Paris	23 June 1894	35 x 28 cm	Good

Figure 7. Object OM-00000017. Source: Olympic Museum Thessaloniki.

ID number	Previous numbers	Category	Description	Permanent position	Material	Collection of Works	Contacts	Place	Date	Dimensions	Condition	WEIGHT
OM-00000061	0865 Ξ072Aii	CUP	Cup awarded as a prize in the Marathon Race of the "Athens 1906" Intercalated Games. Front view inscription "INTERNATIONAL OLYMPIC GAMES IN ATHENS 1906". Back view inscription "ENTHYMEMA MARATHONIOU" (SOUVENIR OF THE MARATHON RUN) The Cup - Marathon Race Commemorative was a key document of the Exhibition: "Olympism. A Modern Invention, an Ancient Heritage" (24.04 - 16.09.2024) implemented by the Louvre Museum in collaboration with the French School of Athens in the framework of the Olympic and Paralympic Games "Paris 2024".	Permanent Exhibition 1900 - 1956	made of a base metal binary alloy Cu-Zn, known as brass, with an amalgam of silver (Ag) and mercury (Hg) to its surface in order to give the silver appearance	ARTEFACT, EXHIBIT	Olympic Museum Collection	ATHENS	1906	31 x25 cm	GOOD CONDITION	911 gr

Figure 8. Object OM-00000061. Source: Olympic Museum Thessaloniki.

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ID number	Previous numbers	Category	Description	Permanent position	Material	Collection of Works	Contacts	Place	Date	Dimensions	Condition
OM-00000001	0000_29 1209	MEDAL	Reproduction of a medal from the Zappian Games of 1870. Front view inscription "ΓΕΩΡΓΙΟΣ Α! ΒΑΣΙΛΕΥΣ ΤΩΝ ΕΛΛΗΝΩΝ" - "GEORGE A! KING OF THE GREEKS" and in the center has a representation of him. On the reverse side is depicted an olive wreath and is inscribed on the inside "ΑΓΩΝΟΘΕΤΗΣ ΕΥΑΓΓΕΛΗΣ ΖΑΓΓΑΣ, ΟΛΥΜΠΙΑ ΑΘΗΝΗΣΙ Α&Ο΄ "(ΖΑΠΠΕΙΑ ΟΛΥΜΠΙΑ) - "GAMES SETTER EVAGELIS ZAGAS, OLYMPIA ATHENS A&O" (ZAPPEIA OLYMPIA)	Permanent Exhibition Revival of the Olympic Games	MEDAL	ARTEFACT, EXHIBIT	Olympic Museum Collection	ATHENS	1870	4 cm	GOOD CONDITION

Figure 9. Object OM-00000001. Source: Olympic Museum Thessaloniki.

Object	Provenance	Date	Description/historical relevance	Materials	Aim	Comparison with similar "objects" of other areas outside Aquileia	Picture rights
Stone wellhead	Found (and still located) within the Domus (belonging to the archaeological area of the Cossàr Fund)	I century BC-I century AD	The well was located in the *atrium* of the domus, the "public" part of the house. In the center of the atrium there was the *impluvium* basin (now rebuilt) with a well. The wellhead, i.e. the protective balustrade closed around the hole of a well, was partially found. The missing part was then reconstructed with 3D printing techniques. The well was not very deep because the aquifer in Aquileia is almost at ground level.	Stone	Rainwater collection for the domus	The wellheads in Roman world are very different from each other, but the general shape is functionally the same	©FondazioneAquileia/Ikon/Nudesign for the 3D reconstruction ©A. Buldrin for the second image ©G. Baronchelli for the third image

Figure 10. Stone wellhead. Source: Fondazione Aquileia.

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Object	Provenance	Date	Description/historical relevance	Materials	Aim	Comparison with similar "objects" of other areas outside Aquileia	Picture rights
Polychrome mosaic with fawn and dog	Titus Macers' House (and still located within the Domus)	End of the 2°century-beginning of the 3°century	The mosaic rich in details and colours, located in the small room overlooking the garden, represents a deer and dog with their jaws wide open. In general, the mosaics kept in the Domus offer a sampling of the tastes in vogue for mosaic decoration.	Mosaic tiles	Decorative use for one of the rooms of the Domus: the studio ("studiolo")		n.1 ©G. Baronchelli n.2 ©A. Buldrin

Figure 11. Polychrome mosaic. Source: Fondazione Aquileia.

Object	Provenance	Date	Description/historical relevance	Materials	Aim	Comparison with similar "objects" of other areas outside Aquileia	Picture rights
Sestertius (ancient coin)	Found in the area of the shops of the Domus. It is now preserved in the National Archaeological Museum of Aquileia.	Dated 235-236 A.D.	Over 1200 coins have been returned from the excavations (of the University of Padua), among which stands out the sestertius of Maximinus Thrax, the emperor who died in Aquileia at the hands of his own soldiers who had laid siege, without success, the city remained loyal to Rome.	Bronze	Commercial use	Coins of Maximinus Thrax are known in other parts of Roman world	©University of Padua

Figure 12. Sestertius. Source: Fondazione Aquileia.

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In all cases, objects are accompanied by descriptive text or metadata that allows for contextual understanding, providing extensive documentation of both existing and new artefacts. From this process, **several fields emerged as commonly present across pilots**, either explicitly provided or derivable from the descriptions. This comparative assessment allowed for a better understanding of the level of readiness of the artefacts. Across the Pilots, a core set of metadata is consistently provided, including:

- Descriptive information: title, category, creator, historical context;
- Technical and material specifications: medium, condition, dimensions;
- Identification and provenance: institutional IDs, inventory numbers, references to the holding collection;
- License: for digital representation, such as photography and instrumentation.

This method enabled a classification of the responses, allowing for the analysis of each pilot's contributions not only as isolated datasets but also in terms of their reusability across a common schema. Despite the differences in collection typologies—ranging from archaeological finds to historical garments and Olympic memorabilia—it was possible to identify **overlapping and recurring fields that can support unified descriptive practices**. These shared elements represent a foundation for the harmonisation of a structures across pilots and contribute to the overall goal of ensuring interoperability and consistency in how digital cultural heritage objects are integrated into the REEVALUATE platform. The first step was to manually identify descriptions and search for common fields. In a second step, using an automation, all the descriptions were grouped and automatically extracted common and main fields that can describe objects in a clear and formal structure.

Table 8. Summarisation of objects from the three pilots. In highlight: groups obtained from general descriptions.

	Pilot 1	Pilot 2	Pilot 3
Object Type	*Dress/skirt suit*	*Telegram/cup*	*Ancient coin/oven / mosaic*
Object ID	*ST503* *ID: 71231 / 54636*	*Clipping of Vikelas Dimitrios' telegram / Merathon Race Commemorative*	*Sestertius/stone oven / polychrome mosaic*
Location	***place**: MoMu – LZ.UNIT.90 Ensembles* ***collection**:* ***creator (digital resource)**: Stany Dederen*	***place**: Thessaloniki Olympic Museum* ***collection**: Panellinios / Olympic Museum Collection* ***creator**: Vikelas Dimitrios*	***place**: National Archaeological Museum of Aquileia / Southernmost shop of the Domus / inside the Domus* ***collection**: Domus of Titus Macer* ***creator**: Roman Empire*
Material	***composition**: wool, plastic/fibre, metal* ***dimension**: 78 cm*	***composition**: Paper, cardboard/metal binary alloy Cu-Zn (brass), with silver and mercury* ***dimension**: 35x28 cm / 31 x 25 cm*	***composition**: bronze/stone bricks/mosaic tiles* ***dimension**: 25 mm / 70 cm*
Social importance	*fashion*	*communication/souvenir of the race*	*commercial use/production of bread*
feature	*small shawl collar, pocket turn-ups, sleeve cuffs*	*handwritten telegram (Greek, English) / inscription INTERNATIONAL OLYMPIC*	*face of Emperor/brick base for millstone, bread*

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	design motiv/description: black wool, plastic buttons at centre front/zigzag motifs formed by raft motiv of a white warp, long, elbow-length, long lapels, press-studs, slanted side pocket, no, blue striped	*GAMES IN ATHENS 1906 (front) - ENTHYMEMA MARATHONIOU (back)*		*preparation counter/deer and dogs rich in details and colours*
Date/Period	*1750 / 1780*	*June 23, 1984 / 1906*		*235-236 A.D. / I century B.C. / end of II century B.C.*
Domain	*Historical fashion*	*Sport*		*Archaeological*
Historical context		*Announcing that the Paris Congress expresses the hope that the celebration of the first International Olympic Games will take place in Athens in 1896. Sent from Vikelas Dimitriosto Panhellenic Gymnastic Association, from Paris to Athens / Olympic Games Athens 1906 Intercalated Games*		*Emperor who died in Aquileia by his own soldiers, over 1200 coins returned / area of the shop of the Domus Titus Macer / Domus of Titus Macro*
Description	***item type**: coat suit/corsage jacket design motiv/description: black wool, plastic buttons at centre front/zigzag motifs formed by a raft motiv of a white warp **features**: small shawl collar, pocket turn-ups, sleeve cuffs **sleeve**: long, elbow-length **lapel style**: long lapels **closure style**: press-studs **pocket**: slanted side pocket **lining**: no, blue striped*	***sender**: Vikelas Dimitrios **recipient**: Panhellenic Gymnastic Association **content**: Announcing that the Paris Congress expresses the hope that the celebration of the first International Olympic Games will take place in Athens in 1896 **format**: handwritten telegram (Greek, English) **sent from**: Paris **sent to**: Athens*	***item type**: Cup of the Marathon Race **inscription**: INTERNATIONAL OLYMPIC GAMES IN ATHENS 1906 (front) / ENTHYMEMA MARATHONIOU (back) **historical context**: Olympic Games **aim**: souvenir of the race **event**: Athens 1906 Intercalated Games*	***item type**: coin of Maximinus Thrax / oven/mosaic paving discovery context: area of the shop of the Domus Titus Macer / Domus of Titus Macro **historical context**: Emperor who died in Aquileia by his own soldiers, over 1200 coins returned **feature**: face of Emperor/brick base for millstone, bread preparation counter/deer and dogs rich in details and colours **aim**: commercial use/production of bread **comparison**: known in other parts of the Roman world / Pompeii*

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4 Digitalisation of the CH artefacts

To address the need to provide some digitised artefacts for each Pilot, to be used both for identification and the execution phase, a study about general digitising technologies has been carried out.

The digitalisation of cultural heritage encompasses a multidisciplinary suite of advanced techniques and methodologies aimed at the accurate documentation, preservation, and virtual dissemination of artefacts and sites. For fashion heritage, digital capture often relies on high-resolution 3D recording technologies such as **digital photography**, which enable the precise recording of complex textile geometries, surface textures, and colour fidelity. These methods are frequently complemented by an imaging system to document material composition, dye patterns, and degradation states, facilitating both conservation and digital archiving. Additionally, parametric modelling and digital sewing simulation software allow for the virtual reconstruction and animation of garments, providing dynamic visualisations for research and exhibition purposes.

In the context of the Museum's objects, a combination of metrological-grade **3D scanning and photogrammetric workflows** is employed to generate accurate 3D models of three-dimensional objects such as archaeological finds, fragments, vases, medals, sports equipment, sculptures, and memorabilia. The digitisation process often includes material characterisation through techniques to document the composition and provenance of artefacts without physical sampling. Also, for archaeological areas, **LiDAR scanning and unmanned aerial vehicle (UAV) photogrammetry** provide high-resolution topographic data critical for mapping and monitoring excavation sites and landscape features. These geospatial data sets are integrated within Geographic Information Systems (GIS) to support spatial analysis, stratigraphic interpretation, and site management. So, in most cases, digitising is a process that involves both 2D and 3D representations of objects, being the process of transformation of data from analogue to digital form.

4.1 Main techniques and technologies for 2D and 3D digitising of Cultural Heritage artefacts

2D digitising is a scientific technique that involves several aspects to ensure proper representation of the object without distortions and colour aberrations. Setting up a **photographic digitisation** station requires careful consideration of lighting, camera equipment, positioning, and environmental control to ensure high-quality, consistent, and reproducible digital captures. The process begins with selecting a suitable camera system, typically a high-resolution DSLR or mirrorless camera equipped with a lens for sharp detail reproduction. The camera should be mounted on a sturdy tripod or a copy stand to maintain stability and consistent framing throughout the digitisation session. Lighting plays a crucial role: a controlled, diffuse lighting setup is essential to minimise reflections, shadows, and hotspots on the object's surface. This is commonly achieved using multiple continuous LED light panels or studio strobes fitted with softboxes or diffusers positioned at 45-degree angles relative to the subject. Colour temperature should be standardised (usually daylight balanced at ~5500K) to ensure accurate colour rendition, often calibrated with a colour target or grey card before each session. The **digitisation workspace must be designed** to reduce environmental variables such as ambient light fluctuations, dust, and vibrations. A neutral, non-reflective background and surface are used to prevent colour contamination and unwanted reflections. The object should be positioned securely, sometimes on custom mounts or supports, to avoid movement and to clearly display key features. Camera settings are optimised for maximum image quality—using low ISO to reduce noise, appropriate aperture for depth of field, and manual focus to ensure critical sharpness. Images are

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captured in RAW format to preserve maximum detail and allow for precise post-processing adjustments. A colour calibration workflow involving colour charts and software profiles ensures consistent colour management from capture to final output. Finally, metadata documentation, including object identification, capture settings, and date/time, is recorded alongside the image files to maintain traceability and facilitate asset management. Regular quality control checks are implemented to verify image sharpness, exposure, and colour fidelity throughout the digitisation project [6].

On the other hand, **3D scanning** allows the reproduction of objects in their complete state of both manipulable geometry and texture [7]. The main techniques for the digitisation of cultural heritage or physical objects, from small to medium-sized objects, are structured light scanning and photogrammetry. Setting up a 3D scanning station involves configuring hardware and software components to achieve precise, high-resolution digital models. For **structured light scanning** [8], the core equipment includes a structured light projector and one or more high-resolution cameras. The system projects a sequence of coded light patterns onto the object's surface, and the cameras capture the deformation of these patterns to calculate accurate 3D geometry via triangulation. The scanner can be securely mounted on adjustable stands or a robotic arm to maintain stable positioning and control scanning angles or driven by a human operator. Most of the time, human operators are preferred due to the precise control of the process, being capable of looking at the preview and correcting for missing parts, but most importantly, to avoid impacts and damages to important artefacts. Calibration of the scanner is essential before each session, involving the use of calibration panels or reference targets to ensure spatial accuracy and correct lens distortion. Lighting conditions are controlled to minimise ambient light interference, as structured light scanners rely on projected patterns that can be affected by external lighting. The scanning environment should be shielded from direct sunlight or strong artificial lights, using blackout curtains or controlled lighting chambers where possible. The object to be scanned is positioned on a turntable or a stable platform to allow for multi-angle capture and complete surface coverage. For larger or complex objects, multiple scans are acquired from different viewpoints and later registered and merged in post-processing software to create a unified 3D model [9].

Figure 13. Light structured scanner by Artec 3D (on left); example of digitising of a statue (on right).

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For **photogrammetry**, the setup involves a calibrated digital camera system—often the same high-resolution DSLR or mirrorless cameras used in photographic digitisation—and a controlled environment with diffuse, consistent lighting to avoid harsh shadows and reflections. The object is photographed from multiple overlapping angles, typically ensuring 60-80% overlap between images, to enable accurate feature matching during 3D reconstruction. A turntable or tripod-mounted camera rig can facilitate systematic image capture for smaller objects, while larger objects or archaeological areas may require handheld photography. Both methods require robust data processing pipelines: structured light scanning software reconstructs 3D meshes from captured pattern deformation, while photogrammetry software (e.g., Agisoft Metashape, Reality Capture) uses Structure-from-Motion (SfM) and Multi-View Stereo (MVS) algorithms to generate dense point clouds and textured meshes. Post-processing includes mesh cleaning, hole filling, texture mapping, and model optimisation to produce accurate, usable digital assets. Metadata documentation and quality assurance procedures are integral, recording scan parameters, calibration data, and environmental conditions to ensure reproducibility and long-term usability of the 3D digital surrogates [10].

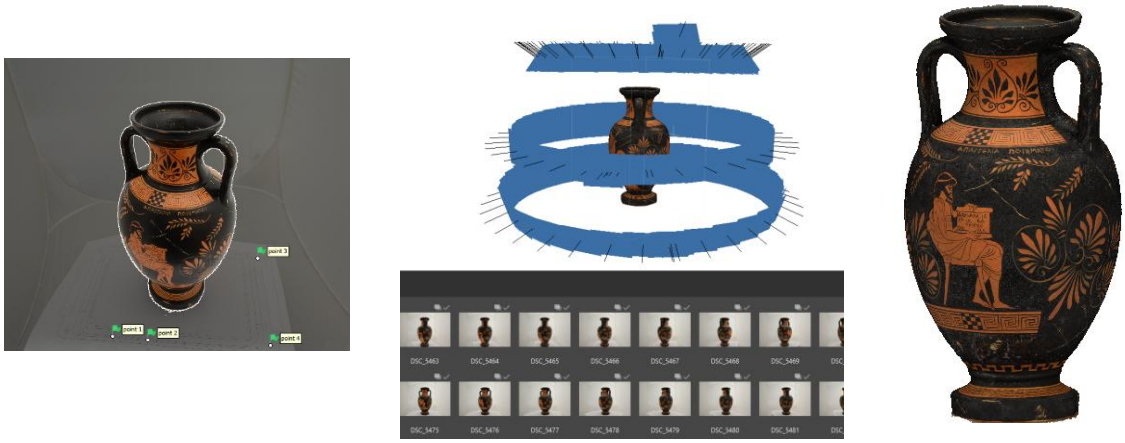

Figure 14. 3D digitising of a vase by photogrammetry during a previous 3DR activity.

Photogrammetry can also be extended to larger areas and buildings, such as archaeological areas, and it is named **aerial photogrammetry** [11]. The workflow for the digitisation of cultural landscapes, archaeological sites, or large-scale heritage contexts involves a series of technical and procedural steps to ensure accurate spatial data acquisition and high-quality 3D reconstruction. The core of the setup is the use of Unmanned Aerial Vehicles (UAVs)—commonly drones—equipped with high-resolution cameras, preferably with fixed focal lengths and global shutters to reduce image distortion. Multi-rotor drones are ideal for detailed site documentation with vertical take-off and landing capabilities, while fixed-wing drones are used for larger areas requiring greater flight endurance. Mission planning is critical and is typically performed using dedicated flight planning software (e.g. DJI GS Pro, Pix4Dcapture, or DroneDeploy), even if precise monitoring of distances between the drone and the site is preferred by manual controls. The flight plan is an important technique because it ensures adequate image overlap — generally 80% forward and 70% side overlap — to allow photogrammetric algorithms to perform reliable feature matching, and require the choice of parameter flight altitude, camera angle (usually nadir for mapping, oblique for facades or volumetric data), and ground sampling distance (GSD). Environmental conditions (e.g. light levels, wind speed) must be carefully monitored according to the site's characteristics and desired model resolution. The registration of undercuts must be executed manually in accordance with the complexity of the site. Before the flight, Ground Control Points (GCPs) should be strategically placed and surveyed to ensure spatial accuracy during the georeferencing stage. Image acquisition is carried out during flight, with camera

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triggering managed by the UAV's onboard system. It is essential to maintain consistent lighting conditions, ideally shooting during overcast days or at solar noon to minimise shadows and exposure variation. Images are captured in RAW format when possible, to retain full dynamic range and maximise detail in post-processing. Once collected, the dataset is processed using photogrammetric software (e.g. Agisoft Metashape, Pix4Dmapper, Reality Capture), which employs Structure-from-Motion (SfM) and Multi-View Stereo (MVS) techniques to generate dense point clouds, digital surface models (DSMs), digital terrain models (DTM), orthophotos, and textured 3D meshes. The integration of the GCPs ensures the final outputs are properly scaled and georeferenced. Post-processing includes editing the mesh, removing artefacts, refining textures, and exporting results in standard formats (e.g. OBJ, LAS, GeoTIFF) for integration into GIS platforms or 3D visualisation tools.

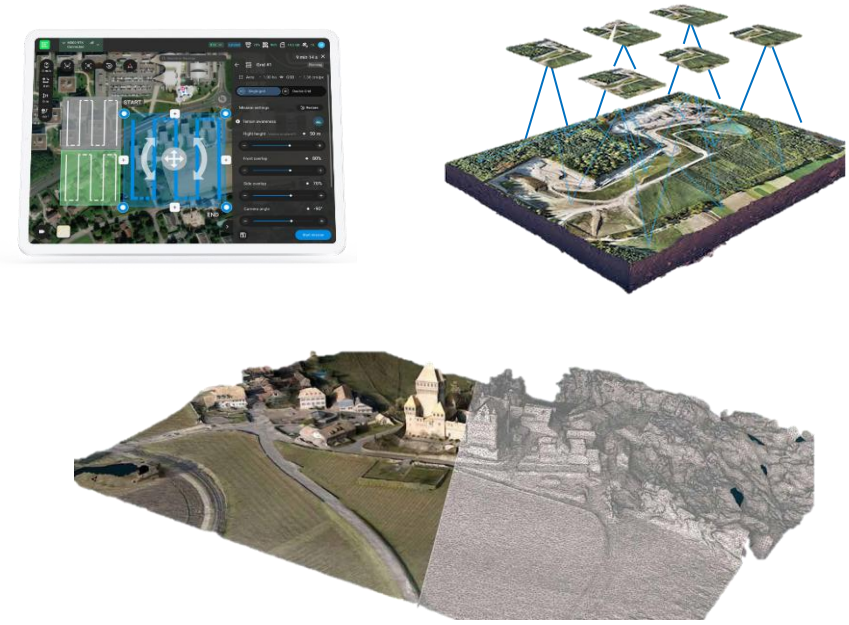

Figure 15. Drone survey with planned path and overlapping images (on top); example of obtained 3D model (on bottom).

Metadata documentation is essential and includes flight logs, camera calibration data, environmental parameters, and coordinate systems used. All assets should be managed in compliance with FAIR data principles (Findable, Accessible, Interoperable, Reusable), ensuring long-term usability and accessibility for both research and public engagement [12].

The digital workflows culminate in the creation of a dataset and derived 3D models from master ones, adequately scaled, decimated and optimised concerning the final delivery, like online 3D visualisation or implemented in VR products, that help and facilitate multidisciplinary collaboration, remote research, and public dissemination, ensuring that archaeological heritage is preserved digitally for future generations. Furthermore, digital asset management systems (DAMS) and standardised metadata protocols ensure interoperability and long-term preservation of digital surrogates within institutional repositories.

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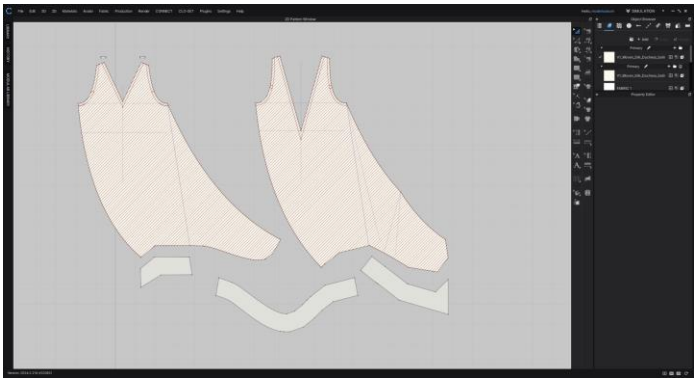
4.1.1 Pilot 1

The workflow for the creation of the assets to be used during the Pilot execution is a 'reverse engineering' pipeline that starts with the selection of digital objects as images of clothes and their patterns. The pattern is first made on paper and traces the different parts of which a garment is composed. Digitisation of these patterns requires two steps: scanning the paper pattern (which creates a raster/pixelated image (e.g. a JPEG) and consequently vectorising the image (tracing the pattern image, which results in a scalable vectorised format (e.g. SVG format)) that can be uploaded in design applications. This means that a 2D representation can be used for a successive 3D representation through proper 3D design software, such as CLO3D (http://www.clo3d.com), that allows designers to create, visualise, and simulate garments in a virtual environment. Enabling realistic garment draping, pattern design, and fitting on customizable avatars, it helps streamline the apparel design process from concept to production. Widely used in the fashion and apparel industries, CLO3D reduces the need for physical samples, saving time and materials. Patterns become three-dimensional, texturisable models ready for deployment to virtual products.



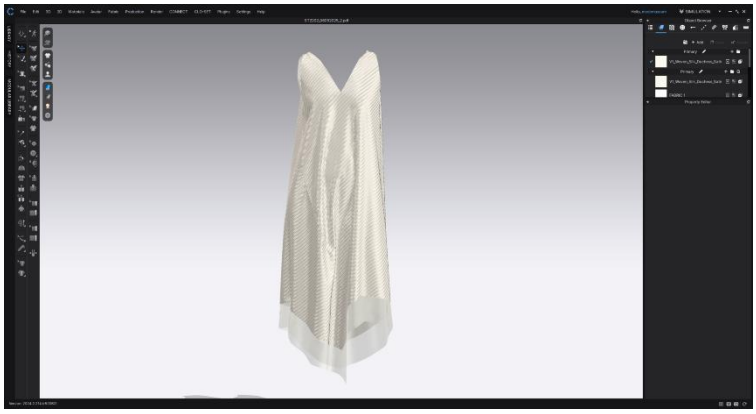


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Figure 16. Test on the Digital Objects n. 1 (ST2202). Top left: digital pattern of the dress. Top right: pattern upload in CLO3D. Middle: creation of a 3D model. Bottom: 3D textured model.

Source: http://data.momu.be/ark:34546/mn0318

The general workflow will be followed regards:

- Selection of the relevant garment to be digitised (with pilot partners);
- Creation of the 2D pattern on paper;
- Digitisation (and vectorisation) of the paper pattern;
- Conversion from 2D pattern to 3D textured model;
- Polycount suitability for performance in virtual environments;
- Lighting, shading, texture resolution, and size compatibility;
- Rigging and skeletal structures (if applicable);
- Standardisation and export in neutral formats (e.g., FBX, GLB, OBJ);
- Deliverable of the file and assessment & recommendation document outlining findings and next steps for further development.

4.1.2 Pilot 2

Considering the Pilot, as the other ones, is in the definition phase of which kind of experience and which objects will be selected by Public Sensing Prioritisation, a digitising plan is in creation. The Pilot consists of already digitised objects (audio tracks, pictures of instruments, pictures of historical telegrams and letters) and requires some digitisation of physical objects such as cups, medals, and other objects coming from the Olympic Museum of Thessaloniki. The plan is to digitise these objects via a **structured light scanner** for the restitution of 3D objects and **digital photography** for image production.

4.1.3 Pilot 3

As part of the preliminary activities within the REEVALUATE project, a field survey was carried out at the Fondazione Aquileia, specifically at the Domus di Tito Macro, one of the most significant archaeological areas within the UNESCO World Heritage site of Aquileia. The on-site technical survey was conducted on February 17 at the Fondazione Aquileia. The objective of this visit was to assess the site's specific characteristics and logistical conditions, and physical conditions to identify the most appropriate technologies and methods for the digitisation of selected cultural heritage artefacts and architectural features. The Domus di Tito Macro, with its complex architectural layout and stratified archaeological layers, presents both opportunities and challenges for digital documentation. During the survey, technical observations were made regarding lighting conditions, accessibility, surface materials, and the physical state of the artefacts and structures to be digitised. The information gathered during this visit is proving instrumental in guiding the selection of digitisation technologies that balance high-fidelity capture, efficiency, and compatibility with the REEVALUATE framework. In particular, it supports decisions regarding the required equipment, workflow planning, and post-processing tools needed to create accurate and reusable digital assets that will be integrated into the virtual experience, output of the Pilot 3.

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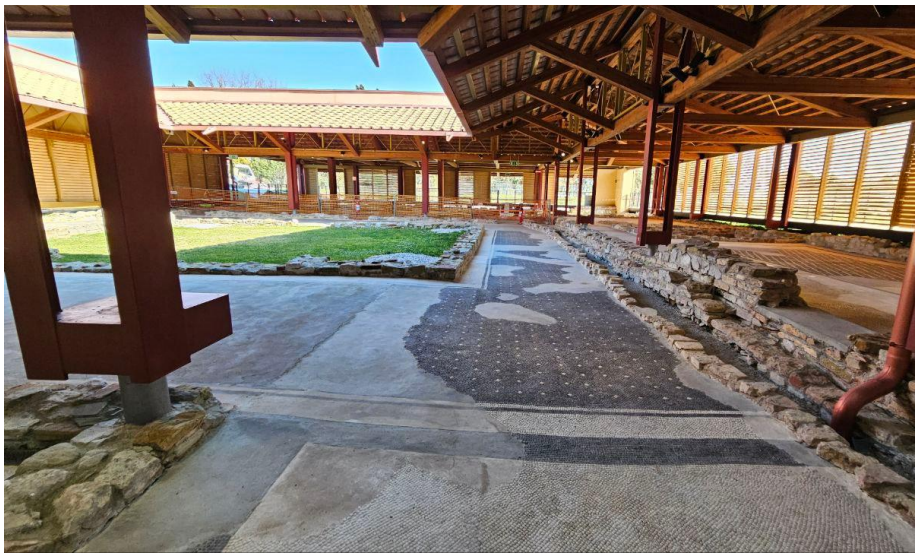

Figure 17. Photos taken during the survey in Aquileia. Multiple views of the Domus Titus Macer.

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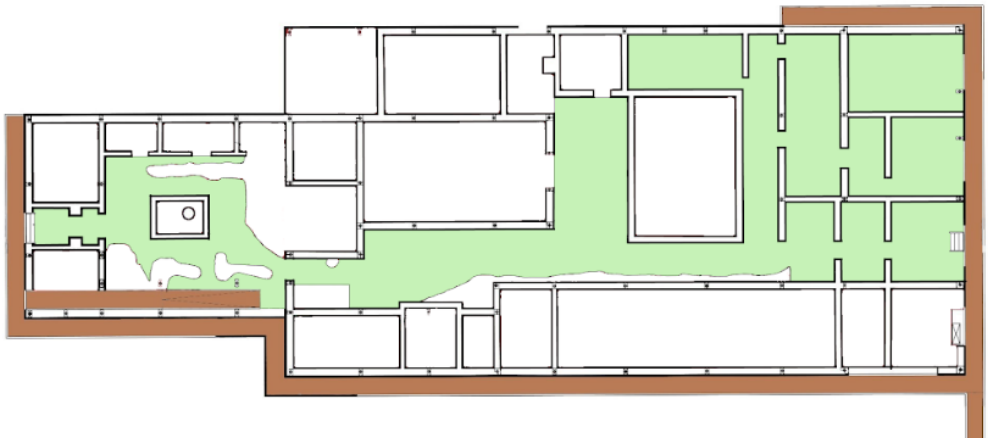

Figure 18. Plan of the Domus Titus Macer in Aquileia.

During the visit, the team examined the layout of the site, the conservation status of mosaics and architectural remains, as well as light conditions and site accessibility, both for operators and equipment. Particular attention was paid to areas of the Domus with rich mosaic flooring and spatial complexity, which are ideal candidates for high-resolution 3D models. The team also reviewed logistical aspects such as equipment transport, power supply availability, and safety protocols. The insights collected during the February 17 survey are being used to define a digitisation strategy: this includes selecting the appropriate hardware and software tools, defining data formats and standards, and ensuring that all outputs are interoperable and suitable for reuse in virtual experiences, digital exhibitions, and public engagement tools.

This on-site analysis allowed the project team to evaluate and define that, in order to address the digitising of the area, the techniques to be used are **photogrammetry** mixed with **aerial photogrammetry**. The digitising of the area will be executed considering this workflow:

- Survey and delimiting of the area;
- Positioning of codified 12-bit markers;
- Measurements between markers;
- Aerial photogrammetry by drone in manual driving, covering the entire area;
- Manual photogrammetry by camera, ensuring the coverage of undercuts and details;
- Preliminary alignment on-site, to verify the coverage;
- Removal of markers, instrumentation, and delimiters.

Structured-light 3D scanner will be used instead for artefacts exposed in the National Archaeological Museum. Reduced impact will involve the objects, preferring the digitising on site without the need to move them if they are subjected to poor integrity or damage.

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5 Conclusion

Task 2.1 focused on the identification and digitisation of cultural artefacts across three diverse pilot contexts: fashion heritage, Olympic and ethnographic collections, and Roman archaeology. Through direct collaboration with CHIs, the task combined existing digital resources with carefully planned digitisation to ensure that each pilot had meaningful, context-aware content to work with. The process revealed key insights about institutional readiness, metadata quality, and interoperability challenges, while also highlighting the creative potential of cultural reuse across fashion, sports heritage, and archaeology. Digitisation was never treated as an isolated goal, but as a strategic means to enable real experimentation and user engagement in later project stages.

This work began with the design and distribution of a standardised questionnaire to assess the availability, typology, and technical specifications of existing digital assets within partner CHIs. Based on the responses, collections were mapped, metadata was analysed, and representative artefacts were selected for each pilot. Where gaps were identified—especially in Pilot 2 and Pilot 3, targeted digitisation efforts were planned using several 2D and 3D scanning combined techniques. In other cases, such as Pilot 1 and a subset from Pilot 2, already digitised content was validated, enriched with metadata, and organised for reuse.

A comparative analysis of all selected objects allowed the consortium to identify recurring metadata fields and establish a harmonised structure suitable for integration within the REEVALUATE platform. In parallel, the deliverable includes a comprehensive technical overview of 2D and 3D digitisation methodologies applied across Pilots.

This deliverable supports technical development and clarifies the needs of each Pilot for the execution phase. The methodological consistency applied across all pilots enabled a coherent collection, ensuring that artefacts can be effectively integrated within the REEVALUATE digital framework.

This deliverable is the first part of the two outcomes expected from Task 2.1. The second part of the deliverable - D2.1b, also known as D2.4 - will be released on M28 (April 2026) and will contain all the digitised and collected objects from each Pilot.

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Annex 1

PARTNER		SHORT NAME
CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS	CENTRE FOR RESEARCH & TECHNOLOGY HELLAS	CERTH
Fraunhofer FOKUS	FRAUNHOFER INSTITUTE FOR OPEN COMMUNICATION SYSTEMS FOKUS	FOKUS
.fs	FROMSCRATCH DESIGN STUDIO BV	FS
FONDAZIONE links PASSION FOR INNOVATION	FONDAZIONE LINKS - LEADING INNOVATION & KNOWLEDGE FOR SOCIETY	LINKS
FFP PRODUCTIONS	FFP FILM- & FERNSEHPRODUKTION GMBH	FFP
NUROGAMES	NUROGAMES GMBH	NURO
GVAM MOBILE GUIDES FOR ALL	GVAM GUIAS INTERACTIVAS SL	GVAM
Stiftung Preußischer Kulturbesitz	STIFTUNG PREUSSISCHER KULTURBESITZ	SPK
Hypertech	HYPERTECH	HYP
Thessaloniki Olympic Museum	OLYMPIAKO MOUSEIO	OLYMPIC
ARTHUR LEGAL, STRATEGIES & SYSTEMS	ARTHUR'S LEGAL BV	ARTHUR

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KU LEUVEN	KATHOLIEKE UNIVERSITEIT LEUVEN	KU Leuven
MODEMUSEUM ANTWERPEN	AG CULTURELE INSTELLINGEN ANTWERPEN/ ERFGOED	MoMU
EUROPEAN FASHION HERITAGE ASSOCIATION	EUROPEAN FASHION HERITAGE ASSOCIATION	EFHA
3D RESEARCH	3D RESEARCH SRL	3DR
FONDAZIONE AQUILEIA	FONDAZIONE AQUILEIA	AQUILEIA

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