CRITICAL EVALUATION OF CULTURAL HERITAGE ARCHITECTUAL STANDARD DOCUMENTATION METHODS ACROSS DIFFERENT EUROPEAN COUNTRIES

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ABSTRACT:
This article presents the current guidelines/standards for architectural documentation in various countries. Available regulations, applicable documents, technical guidelines, and good practices were analysed, together with selected examples of 3D digitisation projects. The results of the evaluation were compared with the guidelines for generating 3D documentation proposed by The Expert Group on Digital Cultural Heritage (EU) and Europeana. The analyses show no unambiguous hard technical guidelines. Still, there is a set of proposed guidelines and good practices to correctly carry out the 3D digitalisation process and the selection of equipment for the inventory of selected classes of object types. For this reason, it is recommended to detail the guidelines for the selection of equipment and the possible accuracy of the final architectural documentation derived from geospatial data.

1. INTRODUCTION

Digital technologies rapidly change our lives, creating new opportunities for various sectors, including cultural heritage institutions. Digital technologies offer more effective tools to digitise, protect, and visualise cultural heritage resources and reach a wider audience. As highlighted in the communication 'Digital Compass for 2030: Europe's path in the digital decade' (European Commission, 2021a), digital technologies have become indispensable for work, learning, socialising, entertainment, and access to a wide range of services and products. The COVID-19 pandemic has highlighted the strengths and weaknesses of the cultural heritage sector and the need to accelerate its digital transformation to make the most out of the rising opportunities. Many cultural institutions suffered severe financial losses or had to close. However, despite the economic challenges caused by the pandemic, many have managed to maintain and even expand their audiences by increasing the range of digital services (e.g., engaging with audiences, making collections accessible, and offering digital tools), once again proving their high value to society and the European economy.

The evaluation of the Commission Recommendation (Decision of the European Parliament and the Council establishing the 2030 Policy Programme "Path to the Digital Decade") on the digitisation and online accessibility of cultural material and digital preservation (2011/711/EU) (European Commission, 2021b) concluded that some of the challenges faced by the cultural heritage sector 10 years ago are still valid, such as the urgent need to protect and preserve European cultural heritage, and in particular cultural heritage at risk. However, the assessment also concluded that the cultural heritage landscape has changed significantly in recent years. There are new needs, but above all, new opportunities that could further enhance the contribution of cultural heritage to the European economy. It is, therefore, necessary to provide a policy response that answers to these new needs and expectations of the heritage sector, the cultural and creative industries, and the general public.

The development of advanced digital technologies such as 3D, artificial intelligence (AI), machine learning, cloud computing, data technologies, virtual reality, and augmented reality have brought unprecedented dense opportunities for digitisation, online access, and digital preservation. Advanced digital technologies lead to more efficient processes (e.g., automatic metadata generation, knowledge extraction, machine translation, optical character recognition, etc.) and improved content quality. They enable innovative forms of artistic creation while simultaneously opening new possibilities for digital participation in and use of cultural content through collaborative content curation, co-design, and crowdsourcing, increasing the involvement of society. Using AI, blockchain, and other advanced technologies allows identifying cultural assets that are being illegally trafficked automatically.
3D technologies do not only serve documentation, preservation and restoration purposes but can also provide heritage institutions with better opportunities to reach wider audiences through engaging experiences providing virtual access to places that are usually inaccessible (e.g., underwater), temporarily closed, or reach the visually impaired by offering, for example, accessible tactile experiences. In this regard, a particular focus on 3D digitisation of endangered cultural heritage and the most frequently visited monuments, buildings and cultural and heritage sites would increase the security, value and potential of historical sites and artefacts.

This article critically evaluates current practices/ guidelines for 3D digitalisation and issues related to using new technologies in the documentation and spatial analysis of cultural heritage assets versus legal requirements across different countries, namely Germany, Greece, Poland, and the United Kingdom. This study was initiated by identifying and evaluating current practices/guidelines related to the 3D digitisation of museum collections and cultural heritage sites. In addition, requirements of tender documents were analysed, particularly the description of the procurement of the 3D documentation for each country over the last 5 years.

The following parameters/information were analysed: (1) "good practice"/official document/description of the 3D documentation procurement (Pro3D), (2) acceptable acquisition methods and techniques related to specific documentation generation, (3) methods for documentation of architectural objects, taking into account the size of the object under examination, (4) accuracy standards for the generation and processing of: point clouds, 3D models and their representations, orthoimages, vector drawings and cross-sections, (5) metadata generation and storage, and (6) data recording and storage.
As part of the research, a SWOT analysis of the adopted data processing standards will be carried out, and the results obtained will be compared with the 10 basic principles proposed by the Expert Group on Digital Cultural Heritage, Europeana and the 3x3 CIPA rules.

2. 3D DIGITALISATION ACROSS THE EUROPE

Cultural heritage (CH) documentation using modern non-destructive measurement technologies is now a standard approach. It is also an inseparable and, at the same time, a crucial part in the complete and sustainable management and protection of historic sites, especially architectural buildings.
The use of image and range-based technologies (i.e., digital close-range photogrammetry, laser scanning, Global Navigation Systems (GNSS), drones, ground penetrating radars (GPRs) and Microwaves systems) is becoming a standard. Particularly the combination of the processes named above with advanced data processing methods based on geospatial technologies such as graphical information systems (GIS), computer vision, robotics, machine learning and big data analysis. This allows for the inventory of heritage sites with a high degree of accuracy and the rediscovery of their history, providing new insights into the monuments.

We are currently in the fourth industrial revolution, known as Industry 4.0, which will revolutionise supply chain automation, monitoring and analysis through smart technologies. It is driven by the Industrial Internet of Things (IoT) and cyber-physical systems - intelligent, autonomous systems that use computer algorithms to monitor and control physical actors such as machines, robots, and vehicles. Industry 4.0 makes everything in the supply chain 'smart' – from smart manufacturing and factories to smart warehousing and logistics. Industry 4.0 does not stop at the supply chain. However, it combines with back-office systems, such as enterprise resource planning (ERP), to give companies unprecedented visibility and control. Ultimately, Industry 4.0 is at the heart of digital transformation.
Industry 4.0 is based on technological pillars (cutting-edge technologies), such as mobile technology and devices, Internet of Things (IoT), smart sensors, location-based services (LBS), big data analytics, augmented reality, artificial intelligence (AI), machine learning, cloud computing, 3D printing and many more. It is unavoidable that Industry 4.0 will be the next domain of influence for cultural heritage documentation. Various processes, like data and information collection, data processing, and data sharing and dissemination, will be significantly influenced by Industry 4.0 technologies (Stylianidis, 2019).
For this reason, it is necessary to take a critical look at the current legislation, the recommendations on the inventory of architectural heritage sites in force in various European countries and the recommendations of the European Parliament.

2.1 3D digitisation of Cultural Heritage – the objective of European commission

The Expert Group on Digital Cultural Heritage (EU) and Europeana in August 2020 prepared 10 basic principles (including sub-principles) relating to the 3D digitisation of cultural heritage (Expert Group on Digital Cultural Heritage and Europeana, 2021). These principles are prepared especially for cultural heritage professionals, institutions, and other custodians of tangible cultural heritage, including local and regional authorities, who oversee cultural heritage buildings, monuments, or sites and have no experience with 3D digitisation yet. These principles can also be used by all other professionals, institutions, and authorities, who may find principles helping them achieve the best results in 3D digitisation projects. The proposed principles are captured and presented by Expert Group on Digital Cultural Heritage and Europeana, (2021), but do not explicitly define which 3D documentation methods should be used, which sensor should be used to acquire the data and how, using which algorithms, the data should be processed. For this reason, these principles should be regarded as general guidelines for preparing a 3D digitisation project. Specific guidelines should be sought in the respective countries' technical manuals or good practices.

2.2 Digitisation of Cultural Heritage – The London Charter

The attractiveness of digital forms and their huge possibilities for depicting the monument are tempting forms of documentation eagerly presented in museums and publications. The visual factor is becoming paramount regardless of the data at hand. Based on rising concerns over the indistinct usage of digital visualisations without the ability to verify the certainty of hypothesis versus raw data, in 2009, an international group of scientists created a document defining the principles of computer methods of visualisation of Cultural Heritage, the so-called London Charter ("THE LONDON CHARTER FOR THE COMPUTER-BASED VISUALISATION OF CULTURAL HERITAGE Preamble Objectives Principles," 2009). It addresses issues in the research on monuments and the dissemination of knowledge about cultural heritage in academia and museums, as well as in education and commercial activities. It introduces the concept of paradata, which includes the documentation of all decisions made to modify raw data and enrich it with hypothetic assumptions, e.g., for a virtual reconstruction (Bentkowska-Kafel 2012). It has been widely discussed and was inspiring for other charts (e.g., The Seville Principles of Virtual Archaeology, 2017); however, this document has no legal force. The content included is only recommendations and a set of good practices, as no specific legal regulations define the rules for using digital technologies.

2.3 CIPA 3-by-3 Rules

One of the most widely quoted and used guidelines relating to the inventory of heritage sites is photogrammetric documentation of architecture written, tested, and published by (Waldhaeusl & Ogleby, 1994), also known as Photogrammetric Capture The '3-by-3' Rules. They refer to three key rules, which we can include (1) 3 geometrical rules, (2) the camera rules and (3) organisational rules.
The proposed guidance on geometrical rules relates to how to define the reference control network (in the form of signalised reference points or scale bars), how to take photos for wide area stereo photo cover and detail stereo photo cover. This document presents basic information on the minimum coverage between stereo images, how to take the images and how to select the appropriate distance-base ratio defining where to take the imag-

es, which allows for obtaining the highest possible accuracy of 3D coordinates points determination.

In the group of recommendations relating to camera rules, information is presented on cameras and lenses to be used, how geometry and radiometric calibration should be carried out and how images should be taken (image exposures). It should be emphasised that the guidelines presented in this paper allow the correct planning of photogrammetric measurements, the camera calibration procedure, and the selection of a suitable non-metric camera.

The last group of recommendations relates to procedural rules concerning, among other things, the necessary documentation in the form of diagrams with the positioning of the camera positions around the site to be surveyed, with reference points, indicated, the metadata to be assigned to the images, and how the data should be stored and archived.

It should be emphasised that, despite the passage of years and changing technologies for acquiring and processing non-metric close-range images, the 3-by-3 rules presented in this study are still valid but have been updated. A new version has been issued to adapt to the digital age (Llerma 2013). And by fulfilling the guidelines presented therein, which should be regarded as the minimum (in relation to modern methods of processing terrestrial photographs), it is possible to obtain high-resolution architectural documentation.

3. RESULTS

The analysis's first stage involved identifying guidelines/recommendations/standards for architectural inventories. It was established that there are no minimum requirements for documentation in all investigated countries, only 'good practices'. For this reason, it was also decided to analyse tender documents covering issues related to the inventory of the interior and exterior of buildings. The example of the (1) list of the reviewed sources and (2) analysis of the results based on the guidelines across different countries were presented in Table 1 and Table 2, respectively. The results identified a significant difference in the documentation methods, i.e., the equipment, accuracy, and requirements for the final form of the documentation.

Country	No.	Year of publication/ last udated	Indoor/ Outdoor	Institution	Document name in English	Document in native language	Reference
Poland	1	2021	Indoor/ Outdoor	National Heritage Board of Poland (Narodowy Instytut Dziedzictwa – NID)	Good practice in documenting architectural monuments with contemporary methods of digital terrestrial recording	Dobre praktyki w zakresie wykonywania dokumentacji zabytków architektury współczesnymi metodami naziemnej rejestracji cyfrowej	(Narodowy Instytut Dziedzictwa, 2021a)
	2	2021	Indoor	Narodowy Instytut Muzealnictwa i Ochrony Zabytków - NIMOZ	Catalogue of Good Practice for the Digitisation of Museum Objects	Katalog Dobrych Praktyk Digitalizacji Obiektów Muzealnych	(Narodowy Instytut Muzealnictwa i Ochrony Zabytków, 2021)
	3	2021	Indoor/ Outdoor	National Heritage Board of Poland (Narodowy Instytut Dziedzictwa – NID)	The 3D digitalisation of wooden sacred objects	Digitalizacja 3D drewnianych obiektów sakralnych	(Narodowy Instytut Dziedzictwa, 2021b)
	4	2020	Indoor	Castle Museum in Łańcut (Muzeum - Zamek w Łańcucie)	Acquisition of source measurement data for architectural documentation	Pozyskanie źródłowych danych pomiarowych do dokumentacji architektonicznej	(Zamek w Łańcucie, 2020)
United Kingdom	1	2015		Historic England	Metric Survey Specifications for Cultural Heritage	-	(Andrews et al., 2015)
	2	2018		Historic England	3D Laser Scanning for Heritage	-	(Boardman, C., Bryan, P., 2018)
	3	2017		Historic England	Photogrammetric Applications for Cultural Heritage	-	(Historic England, 2017)
Germany	1	2003	Indoor/ Outdoor	Heritage Authorities Baden – Württemberg	Recommendations for building documentation	Empfehlungen für Baudokumentationen	(Eckstein 2003)

	2	2020	Outdoor/ Archaeology	Heritage Authorities Bavaria	Guidelines for the documentation of archaeological excavations in Bavaria.	Vorgaben zur Dokumentation archäologischer ausgrabungen in Bayern	(BLfD Bayerisches Landesamt für Denkmalpflege, & Sandner, 2020)
Austria	1	2015, updated 2018	Indoor/ Outdoor	Austrian Heritage Authorities	Recording and documentation of buildings and outdoor facilities Part 2: As built and building recording of listed objects	ÖNORM A6250-2 Aufnahme und Dokumentation von Aufnahme und Dokumentation von Bauwerken und Außenanlagen Teil 2: Bestands-und Bauaufnahme von denkmalgeschützten Objekten	(ÖNORM, 2015)
Greece		2022	Outdoor	European Commision	Study on quality in 3D digitisation of tangible cultural heritage	-	(European-Commission, 2022a)
Cyprus		2022	Outdoor	European Commision	Study on quality in 3D digitisation of tangible cultural heritage; Annex 2 - Exemplifications of Complexity	-	(European-Commission, 2022a)
European Union		2022	Indoor/ Outdoor	European Commision	Study on quality in 3D digitisation of tangible cultural heritage; Annex 2 - Exemplifications of Complexity	-	(European-Commission, 2022b)

Table. 1 The list of documents used to analyse standards and guidelines for architectural documentation

United Kingdom: Historic England's Metric Survey Unit started in about ca. 2008 to issue openly accessible recommendations on their guidelines and tender of the heritage documentation by laser scanning and digital imaging technologies based on principles of engineering metrology. The recommendations go down to the plans' single layer name and line widths. Historic England, or as it was then named English Heritage, has had a spearheading role and actively integrated its own guidelines into the tendering process. Historic England has always updated their technology approach, including H-BIM, in later stages. Subsequently, high-quality products of documentation can be observed in the United Kingdom.

In Germany, the Charta of Venice from 1964, with its claim to deliver detailed documentation before any changes to the monument, triggered the development of heritage laws in each state in the 70ies containing similar concepts. With its federal systems, each of the 16 states has its own heritage authorities, which each can propose its own standards and guidelines. Whilst for the planning documents of new builds, a series of standard norms (e.g., DIN 13561 Technical Drawing and normed drawings for architectural and engineering planning as law) exist, there are no German-wide standardised published drawing norms for historic buildings. There is more of a school of "as-built drawing" that has been taught since the 1980ies in universities (e.g., Bamberg School of Heritage Conservation Studies where rules of architectural and technical drawing have been merged with informed documentation of as-built building research plans (1:100-1:5) as the basis for cartography, planning and inventory procedures. The archaeological departments seem to be further in publishing guidelines than the historic architecture departments of the heritage authorities (BLfD 2020). The German and Swiss authorities recently referred to the ÖNORM from Austria from 2015, updated in 2018 (ÖNORM A6250-2, 2015).

Detailed instructions for images and resolutions are given for museum documentation (Hagedorn-Saupe 2011), and is not inserted into table 2 therefore. The heritage community in Germany tends to look at the 3-by-3 rules and photogrammetric norms to be guided in the documentation (Lema et al., 2013).

Poland: The main legal act relating to the protection of cultural heritage is the Constitution. The field of culture is directly addressed by Article 73, which states that everyone is guaranteed freedom of artistic creation, scientific research and the publication of its results, freedom of teaching, and freedom to enjoy cultural property. The main policymaker is the Minister of Culture and National Heritage. Cultural administration bodies are located at the voivodeship (regional), poviat (district) and municipal levels. Each local government level has a statutory obligation to undertake activities in culture and the protection and care of monuments.

Conservation standards and methods of dealing with monuments are defined in the Act of 23 July 2003 on the Protection of Monuments and the Guardianship of Monuments. (Rada Minstrów Rzeczpospolitej Polskiej, 2018)
The functioning of museum units in legal terms is regulated by the Act on Museums of 21 November 1996 (Rada Minstrów Rzeczpospolitej Polskiej, 1997).

Poland became a party to the UNESCO Convention on the Protection of the World Cultural and Natural Heritage in 1976.

Since then, it has been involved in the work of the World Heritage Committee aimed at the preservation and conservation of cultural properties.

Despite the many pieces of legislation concerning the preservation of cultural heritage, there is a lack of specific regulations concerning the use of new technologies and standards for digital documentation.

Despite the widespread use of the method and access to a diverse assortment of instrumentation, it has not yet been possible to introduce a consistent scheme for data acquisition, processing, and publication and framework guidelines for the minimum level of mapping resolution, data quality or recording formats.

Type of documentation	Country	No.	Acquisition method	Colour/ intensity	Density	Accuracy/ GSD/Resolution	Metadata	Storage format	Metadata files
Images	Poland	1	Camera	+/-	N/A	-	Yes	8-bit TIFF/DNG	Calibration report
		3	Camera	+/-	N/A	Resolution min. 24 Mpx	Yes	8-bit TIFF/DNG	Calibration report/Georeference
		4	Camera	+/-	N/A	GSD = 1mm	YES	RAW/8-bit TIFF	Calibration parameters
	United Kingdom	1	Camera	+/-	N/A	-	YES	8-bit TIFF	IPTC/EXIF
		3	Camera	+/-	N/A	-	YES	12-bit / 16-bit RAW/ 8-bit TIFF	ADS Metadata
		4	Camera	+/-	N/A	N/A	YES	12-bit / 16-bit RAW/ 8-bit TIFF	ADS Metadata
	Germany	1	D-SLF / Pano as required	Colour only	N/A	Depending on sensor specifications	YES	RAS/Tiff/JPG	EXIF/ recording data/ as requested by institution or client
	Greece	1	Camera	+/-	N/A	1:100	YES	N/A	N/A
	Cyprus		Camera	+/-	N/A	1:10			
	European Union	1	Camera	+/-	N/A	N/A	YES	JPEG, TIFF, RAW, DNG	ARCO (AMS), CRMDIG, METS
Point clouds	Poland	2	TLS	+/+	9 points/cm^2	-	Yes	Native format/PTSPTX /E57/PCD	Sensors' name/ Surveying data used for registration/ Transformation parameters/Registration report/Description of processing steps
		4	TLS	+/+	9 points/cm^2	-	Yes	Native format /PCD/PTS	Transformation parameters/Registration report
		1	TLS/ Photogrammetry	+/(+)	min. 3 mm/ 1mm	-/ 1mm Registration accuracy (relative/exterior) 2mm / 10 mm	Yes	Native format/PTSPTX	Sensors name
	United Kingdom	2	TLS	+/+	6mm/10 m Spatial		YES	E57	Certificate of calibration/ scan metadata with MORPHE standard
			Triangulation/ Terrestrial Laser Scanning	+/+	Triangulation: Scale 1:5- 0.5mm Scale 1:10 – 1mm Terrestrial Laser Scanner: Scale 1:20 – 2.5mm, Scale 1:50 5mm Scale	Triangulation: 1:5- 0.5mm 1:10 – 1mm Terrestrial Laser Scanner: 1:20 – 2.5mm, 1:50 5mm 1:100- 15mm	YES	E57/LAS/LAZ/ PTS/PTX/TXT	Scan Metadata/ Registration Metadata

					1:100-15mm				
	Germany		TLS	+/+	Settings to according to TLS model and planned use of point cloud	Resolution/ point distance after subsam-pling : (1) 1:100/ 1:50 -> 15mm; (2) 1:50 - >5 mm; (3) 1:25 -> 2,5 mm (4) 1:10 - > 1mm	Yes, for the recording	Raw data/ e57/las/	Recording metadata, Registration report , delivery according to required office/ Institutional Standards.
	European Union	1	Triangulation/ Terrestrial Laser Scanning/photogrammetry	+/+	N/A	0.5 cm		LASS/LASS/E57/NATIVE	SMITHSONIA, LIDO, CARARE, ARCO, CRMDIG, METS
Vector drawing/ Cross-sections	Poland	2	Point clouds	-	-	1:50 – 1:10 1:50 – 1:20	No	DWG/PDF	-
		3							
		4	Point clouds	-	-	1:20/ 1:20 (1:50)	No	DWG/PDF	-
		1	Point clouds	-	-	5 cm	-	SHP/DWG	-
	United Kingdom		Topographic Surveying	N/A		0.3mm related to the drawing scale	-	PDF/CAD/Plotting	-
	Germany		Total station/ CAD	N/A		According to scale (see SfM)	Yes	PDF/CAD/DWG-DXF-SVG	Recording metadata / polygon report/ information on plan drawings
3D data	Poland	2	TLS/ Photogrammetry	+/-	-	0.12 cm/ 0.05 cm	N/A	OBJ/FBX	Texture
		3	TLS/ Photogrammetry	+/-	-	8-12mm/Res: 50mm/LoD3	YES	OBJ	Texture
		1	TLS/ Photogrammetry	+/-	-	8-12mm/Res: 50mm/LoD3	YES	OBJ	Texture
	United Kingdom		Topographic Surveying	N/A		0.5mm related to the drawing scale	-	PDF/CAD/Plotting	-
	Germany								
	Greece		TLS/ Photogrammetry	+/-	N/A	0,7 cm	YES	N/A	N/A
	Cyprus		TLS/ Photogrammetry	+/-	N/A	6,4/0,5 cm	YES	N/A	N/A
	European Union	1	TLS/ Photogrammetry	N/A	N/A	0.5 cm	YES	OBJ/STL/PLY/ X3D	SMITHSONIA, LIDO, CARARE, ARCO, CRMDIG, METS
Orthoimage	Poland	3	TLS/ Photogrammetry	+/+	N/A	2 mm	YES	8-bit TIFF	TFW file
		4	TLS/ Photogrammetry	+/+	N/A	2 mm	YES	8-bit TIFF	TFW file
		1	TLS/ Photogrammetry	+/+	-	2 mm	YES	8-bit TIFF	TFW file
	United Kingdom	3	Photogrammetry	+/-	N/A	Scale 1:10 – 1mm GSD 1:50 – 3mm GSD	-	8-bit TIFF	-

			Camera/ TLS	+/-	N/A	Scale 1:10- 1mm GSD Scale 1:50- 3mm GSD Scale 1:100- 10mm GSD Scale 1:200- 20mm GSD	YES	8-bit TIFF	ADS Metadata
	Germany		SfM/Photogrammetry / TLS	+/-	N/A	(1) 1:100/ 1:50 -> GSD 10mm; (2) 1:50 - > GSD 3mm; (3) 1:25 -> GSD 2mm (4) 1:10 - > GSD 1mm	Yes	TIFF/JPG/PDF	According to Institution or office regulations/ client demands
BIM	United Kingdom		Various	-	-	Level 1 to Level 4	-	IFC2.0/ RVT	-
	Germany		TLS/SfM	N/A		LOD1 to LOD4 according to affordances	rarely	IFC / proprietary formats	PDF or text file
SfM	United Kingdom		Camera	+/-	-	+-3mm GCP accuracy Camera with at least 13 million pixels and each pixel must a have a minimum size of 6 microns.	YES	16-bit RAW/ 8-bit TIFF	IPTC/EXIF
	Germany		Camera/ High-monopole	yes		(1) 1:100/ 1:50 -> GSD 10mm; (2) 1:50 - > GSD 3mm; (3) 1:25 -> GSD 2mm (4) 1:10 - > GSD 1mm	yes	RAW (long-term storage)/ TIFF-JPG-PDF-DWG	EXF/Textfile/ PDF – as requested by institution/office/client

Table. 2 Current standards and guidelines for architectural documentation according to selected countries.

In Greece, as in other countries, the obligation to promote artistic creativity and protect cultural heritage derives from the Constitution (Articles 16 and 24). Policymaking is the responsibility of the Ministry of Culture. The Constitution stipulates everyone's right to art and culture and the state's responsibility to promote them. In addition, Article 24 specifies that the protection of the cultural environment (including monuments, traditional areas, and traditional elements of the environment) is the right of everyone and the responsibility of the state. This is addressed in detail by Law No. 3028/2002, which regulates all aspects of cultural heritage protection and management. Specifying, among other things, the rules for conducting archaeological research and any activities at a monument.

The use of new technologies for preservation fits perfectly with the policy of protecting and preserving the integrity of cultural heritage assets. Over the past five years, the Greek Ministry of Culture has undertaken initiatives aimed at, among other things, digitising Greece's tangible (mostly) cultural heritage. The main intention has been to make the best possible use of new technologies for the digital documentation, management and promotion of sites and monuments, both at the level of official government curation, research and education, as well as open public and private initiative in the form of value-added service and creative applications (Mendoni, 2023).

4. CONCLUSIONS

The rapid development of new technologies and their rapid entry into the world of cultural heritage has resulted in a certain legislative gap. At the same time, two types of documentation are legally permitted for the documentation of tangible cultural heritage, but only one is described in detail and standardised. There are specific requirements for analogue documentation, but this does not apply to documentation acquired digitally.

At present, there is no generally accepted EU framework defining the level of detail and accuracy requirements for digital records of tangible heritage: each site is documented based on accuracy and cost specifications provided by the owner or stakeholder.

Our discipline still lacks measurable quality standards - especially in the transition stage from primary data acquisition to processing and storage. There are no defined quality control processes for this research field.

There is a lack of internationally recognised standards or guidelines for planning, organising, managing, implementing, using paradata or metadata, or evaluating Cultural Heritage 3D data acquisition. There are some exceptions at the national level, for example, in the United Kingdom (ang. Heritage and Historic Environment Scotland) and in the US (FADGI). Several international organisations, such as CEN, ISO, Web3D and IIIF actively involved in 3D standardisation.

Table 2 is a collection of publicly available data. In the case of Poland (Castle Museum in Łańcut), Greece (Roussanou Monastery, Meteora Complex), Cyprus (Asinou Church), and Germany, the data was collected based on completed, specific projects. We can't consider the adopted values as standards; they are only illustrative examples.

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