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From Culture to Smart Culture. How Digital Transformations Enhance Citizens' Well-Being Through Better Cultural Accessibility and Inclusion

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ABSTRACT The aim of the paper at hand is to discuss how digital transformations can improve citizens' well-being in terms of cultural consumption possibilities. Culture is traditionally inextricably connected to the life of a city. So far the digital revolution has improved virtually all areas of activity within cities, such as communication, transportation, distribution, healthcare, finance, education, and business. On a similar note, it is high time for culture to follow the same trend in order for citizens to benefit from improved cultural accessibility and inclusion. Without the latter, the cultural experience would be less accessible and/or more costly. First, we showcase local initiatives regarding cultural technology. We then analyze the main initiatives in terms of public policy aimed at improving accessibility and inclusion for memory institutions (galleries, libraries, archives and museums), as well as their implications. Further, we present the main achievements in terms of cultural digitization using as reference the European Digital Library, Europeana. We conclude by highlighting the main benefits and challenges of developing smart culture, with a focus on citizens' well-being.

INDEX TERMS Accessibility, cultural technology, digital library, digitization, e-museum, inclusion, smart culture, smart cities, web 2.0.

I. INTRODUCTION

Culture lies at the very heart of every city, and it has been acknowledged as the fourth pillar of sustainable development by the United Cities and Local Governments (UCLG) [1]. Drawing from UNESCO's Universal Declaration on Cultural Diversity (2001) [2] and Convention on the Protection and Promotion of the Diversity of Cultural Expressions (2005) [3], city leaders and authorities have concluded that culture can contribute to the achievement of sustainable development and well-being. In this context, it is of utmost importance to protect and enhance citizens' access to the existing and expanding stock of information and resources. Therefore, UCLG recommended the integration of culture into city development policies, the development of a solid cultural policy, the inclusion of culture in all public policies, and the promotion of culture as the fourth pillar of sustainable development [1]. Although culture is a notoriously difficult term to define [4], for the purposes of this paper, by culture we understand the arts of describing, showing or performing that represent the traditions or the way of life of a particular group of people, encompassing, inter alia, literature, art, music, dance, theater [5].

A smart city is an urban area in which technological advancements and, particularly, digital technologies and information and communication technology (ICT) are used to enhance systemic capabilities aiming to enhance competitiveness, effectiveness, quality of life, and sustainability, and to address city challenges [6]–[8]. Certain authors argue that ICT still have to address all city sustainability dimensions, such as urban environment and ecology concerns, which are critical for urban resilience [9]–[11]. Nonetheless, it is worth mentioning that there have been large variations in defining smart cities and a lot of contention around the concept. Several factors have been placed in connection with smart cities, such as technological innovation, e-governance,

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communities and social learning, urban growth and social and environmental sustainability, entrepreneurship, cultural development, to name just a few [12]. Self-designated smart cities still need to address labor, housing, city space inequalities, social polarization, as well as conflicts between environment sustainability and economic growth [7].

Urban renewal, regeneration, and revitalization, which are driven by ICT, entrepreneurship, and innovation, should also extend to cover culture through smart digital cultural services, especially in memory institutions. The smart cities model 4.0 (2015) developed by Vienna University of Technology proposes six key fields of urban development: smart economy, smart mobility, smart environment, smart people, smart living, and smart governance. The concern for culture as an essential part of smart cities is justified, as it is found at the junction of several key fields: smart living includes cultural and leisure facilities and education facilities, smart people includes education and lifelong learning, smart mobility includes ICT-infrastructure, smart economy includes city image and innovative spirit, and smart governance includes public and social [13].

Culture being a very broad concept, the paper at hand will only discuss a subset of culture, that of memory institutions. Memory institutions preserve and make cultural and documentary heritage accessible and inclusive to the general public, while disseminating knowledge and creating impact [14], [15]. The memory institution concept relates to the materiality of memory and its association with physical places such as galleries, libraries, archives, museums (GLAMs) [16]. GLAMs ''transmit experience and creativity across the borders of time and space, language and custom, people and individuality'' [17]. They are also important learning environments and repositories of human history and knowledge [18]–[21]. In awareness of these benefits, adopting Internet of Things (IoT) can contribute to the transition from city to smart city, and from culture to smart culture through the existence and operation of unified web platforms and various applications in the digital ecosystem [22], [23]. Inclusion stands, among others, as a significant determinant for the success of smart city applications [24].

The paper discusses the impact of advanced digital technologies on the access to and quality of cultural experience, which generate a higher level of well-being for the citizens. Digital technologies refer to the use of devices that enable access to cyberspace, the use of digital audio/video and ICT [25]. This process is seen as an important step for a city to become a smart city and a critical aspect of expanding digital ecosystems. Digitization only holds a share in the large array of digital technologies, and the reason for elaborating the discussion in this area is both national and regional policy implications and data availability. Digitization is a smart concept because it facilitates and seeks to democratize access to existing resources, it develops and it is also a result of ICT-infrastructure and it improves public services.

The paper is structured on three levels. The first one focuses on the most recent local e-GLAM initiatives, and discusses the main technologies employed in these endeavors. The investigation concerns initiatives based in Asia, America, and Europe. These local initiatives serve as a basis and examples of good practice for broader national and regional initiatives. The survey is based on the recent literature. The second level tackles public policy documents that specifically or tangentially deal with access to smart culture, and cultural preservation and dissemination using new ICT, with a focus on Europe. The third level presents the details of the European Digital Library (EDL) – Europeana [26]. We analyze data on Europeana in terms of digitization initiatives of the EU-28 countries, Europe-wide and the US for the following areas: Art, Photography, Manuscripts, Newspapers, Archaeology, and Natural History. We chose these areas because, in our opinion, they are the most representative for e-GLAM initiatives.

II. LITERATURE REVIEW

Use of IoT in a smart environment may lead to the development of wisdom museums, which are information, digital, and intelligent museums [27]. A wisdom museum combines IoT and environmentally-friendly technologies, thus addressing heritage preservation and protection at the same time. Internet of Cultural Things (IoCT) is IoT put to use in culture [28].

Web and mobile technologies have generally made almost all transactions easier by permeating almost all areas of activity [29], reducing associated costs and waiting times. On-site cultural consumption may sometimes prove to be difficult to achieve due to barriers such as: distance, time, and costs. On a similar note, online access to cultural content via ICT may restrict people not possessing the necessary technology or skills. However, it is important to stress that the existence of ICT infrastructure in culture does not necessarily ensure higher cultural consumption. First, because such technologies raise the following two questions: whether users are aware of applications and solutions, and whether they have the abilities to use them [30]. Second, irrespective of the existing ICT infrastructure or possession of electronic devices, cultural consumption is a matter of education, needs and wants, and personal choices.

According to article 27(1) of the Universal Declaration of Human Rights, ''everyone has the right to freely participate in the cultural life of the community, to enjoy the arts, and to share in scientific advancement and its benefits'' [31]. In this context, we argue that citizens' cultural consumption is likely to grow and their well-being is likely to improve if the information and communication technologies and systems are implemented and used in culture, too [32].

The most common and frequent means of incorporation of ICT in cultural services is by providing online access to, and retrieval from collections and objects on the institutions' websites [21], [33].

Urban policies and systems in the field of culture need to be human-centered and should accommodate all stakeholders' needs. Therefore ICT should be effectively used for the

entire society, including for the most vulnerable citizens or citizens with special needs, in an attempt to reduce polarization [12], [34]. Besides better accessibility for everyone, more advanced ICT make culture more inclusive, especially for citizens with sensory and mental impairments, or for individuals with mobility issues. Technology can, therefore, either replace physical visits to memory institutions, i.e. GLAMs, through digital access, or become tools as part of physical GLAM visits.

Use of technologies in GLAMs can improve visiting experiences, making visits ''an even richer, more vibrant, satisfying and unforgettable experience [35].'' Increased well-being for the vulnerable categories of disabled citizens mentioned above is most obvious in the case of increased accessibility [21], [36]. In addition to offering information or knowledge about the exhibits, ICT can provide open-access personalized, flexible, immersive, interactive and virtual tours and experiences of GLAMs, but also sharing options before, during and after the visit. In culture, digital accessibility needs to be inclusive in order to reach wider audiences [37], [38]. Digital accessibility overcomes barriers of physical presence, which is substituted by online presence [37].

Certain collections have limited public exposure or are no longer available. GLAM exhibits can become available or their longevity can be extended through open online platforms with unrestricted access, in the form of virtual museums using virtual reality techniques or through archives [39], [40]. Virtual museums are ''logically related collections of digital objects mixed in a variety of media that provided connectedness and various points of access [41].'' Virtual museums invite the visitors to be active and to engage, rather than to be passive.

Augmented reality (AR) has also been included in the process of turning museums into smart institutions. AR creates virtual objects into the real world using markers or images [42]. The preservation motive is in line with sustainability goals, as cultural objects will be available for future generations, too.

Accessibility and inclusion can be enhanced through the digitization of GLAM collections. According to Calimera Guidelines, digitization can be achieved: 1) by transposing a document from traditional into digital format, and 2) by organizing digitized documents included in databases, systems or archives [43].

The most common barriers in the way of cultural digitization are the high costs involved, the lack of standards or the unrealistic standards set by best practices, insufficient specialized staff or costly training. The institutions more likely to achieve digitization are the larger ones, which have more resources, whereas the smaller ones fail to engage in or complete this process in the absence of the necessary infrastructure, resources, and staff [44]. Lack of standardized metadata and different collection management systems used in digital libraries without sufficient technical standards are the main barriers in digitizing collections [45].

National digital libraries also face various difficulties, such as updating databases using different sources and with different frequencies, mainly due to lack of formalization and standardization [43]. Apart from technical difficulties, lack or insufficient funds, as well as poor communication between concerned institutions are other shortcomings of the process [43]. Funding should, therefore, be supported by public-private partnerships or through structural funds [46].

Once the digitization of the existing stock of cultural material has been completed, the process does not end here. It is a long-run continuing enterprise, which also involves the digitization of new items and the maintenance of all previously-digitized items. Although the longevity of digital objects generally exceeds that of originals, the former are still subject to deterioration. Hence, there is a need to permanently maintain the database. In order to prevent deterioration and loss, web-harvesting could also be implemented. Cross-border cooperation of institutions is part of the solution to render the web-harvesting process smoother and more efficient. The intention is to ensure all conditions to not overlook material, but also to avoid overlapping efforts and duplicates.

III. MATERIALS AND METHODS

We first survey local initiatives using selected case studies and synthesis, then we perform a critical analysis and discuss the implications of the public policies in the field, and in the end we perform a comparative analysis and descriptive data analysis of the extent of digitization in culture.

In order to describe the context within which these initiatives take place, we used data from Eurostat on the Digital Economy and Society Index (DESI) [47], as well as data regarding use of web technologies for purchasing cultural goods and services [48]. The interest for cultural activities was described and highlighted using data on mean expenditure of private households on cultural goods and services [49], and data on frequency of participation in cultural activities, more precisely data referring to cultural sites (historical monuments, museums, art galleries and archaeological sites) [50]. To highlight the relationship between well-being and cultural digitization, we used data provided by the European Commission in the Cultural and Creative Cities Monitor [51]. The latter covers the most important cities in the EU-28 countries from the perspective of attractiveness and citizens' participation in cultural activities, and compiles data into the Cultural and Creative Cities Index. We particularly focused on Cultural Participation & Attractiveness as a sub-component of this index. The choice thereof was made based on the hypothesis according to which there is a positive relationship between the number of inhabitants and participation in the city's cultural activities. Whereas Europeana data cover the EU-28 countries, Europe-wide and the US, the data taken from Eurostat refer to the EU-28 countries. The data provided by the Cultural and Creative Cities Monitor that were used in this research refer to cities with populations higher than 500,000 inhabitants.

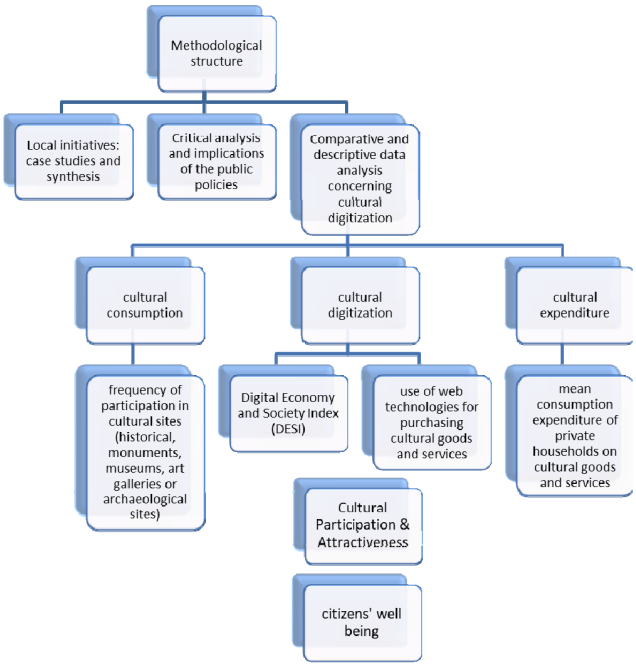

FIGURE 1. Methodological framework.

The research approach is a holistic one (Fig. 1). There are numerous cultural technologies, including digitization. We particularly focused on digitization and digital libraries because this cultural technology is the only one for which there are available data collected by country. Uneven digitization was explained by dint of DESI, which is an approximation of how digital technologies have been integrated in the economy and society. Additionally, we used online purchases of books/magazines/newspapers as a proxy for online cultural purchases, mean consumption expenditure of private households on cultural goods and services as a proxy for cultural spending, and frequency of participation in cultural sites (historical, monuments, museums, art galleries or archaeological sites) as a proxy for cultural consumption.

IV. SMART CULTURE - GOOD PRACTICE EXAMPLES AND UNDERLYING TECHNOLOGIES

This section presents a collection of good practice examples in the field of smart culture. According to Agenda 21 for Culture, the criteria taken into account when selecting good practices examples are: innovation, participation, sustainability, efficiency, transversality, and reproducibility [1]. The survey is useful as it gives a sense of how diverse and technologically advanced all forms of culture can become following the implementation of digital technologies. Local and remote initiatives break cities' physical barriers and embody modalities through which culture can become more inclusive and accessible. Local initiatives represent the very basis and starting point for designing broader cultural policies, such as national or regional digital libraries. Local initiatives can later on be taken over by aggregators or through web-harvesting, within larger initiatives, such as the EDL, which will be further described in this paper. A synthesis of the case studies discussed is presented in Table 1.

TABLE 1. Good practice examples in smart culture.

Zone	Country/City	Outcome and/or technology used
East Asia	China	Museum-based digital exhibits Virtual museum Digital library Web 2.0 technologies
South-East Asia	Singapore	Interactive digital platforms Online archives
North America	Washington D.C.	Digital collection records and surrogates
Western Europe	Italy/Naples	Smart museum based on IoT architecture Sensors and services
	Italy/ L'Aquila	Digital museum Digital and interactive applications
	Italy/Turin	Digital captions on tablets Mobile tags NFC proximity technology 270 degrees circular screen Ubiquitous computing
	Italy/Campania	Service-oriented architecture Context-aware applications
	Italy/Florence	Virtual museum Mobile application Digital objects, digital images
	Italy/Lecce	IoT Indoor location-aware architecture
	UK/Glasgow	Photogrammetry Object VR Interactive .pdf
	UK/Coventry	3D experiences VR
	Belgium/Brussels	Virtual museum
	Belgium/Tervuren	Digitized collections in 2D and 3D models
Northern Europe	Finland	Online access Digital content
Central and Eastern Europe	Romania/Braşov	VR 3D models Laser striping principle
	Croatia/Zagreb	Digitization Archiving
	Turkey/Istanbul	Digital museums

Source: Authors' synthesis based on the literature review

Digital technologies ensuring the operation of e-GLAMs, i.e. cultural technology, are responsible for the newest developments generating increased cultural accessibility and inclusion for citizens. As already shown above, digital technologies refer to the access of cyberspace, the use of digital audio/video and ICT. Examples of such technologies are:

3D representations, big data, AI, VR, AR, 5G, ubiquitous computing, digitization.

It has been shown that, the adoption and use of emerging cultural technologies in China have led to increased well-being. China has included cultural technology in top-level national policies for the creative industries, with a particular focus on culture and heritage. The purpose of the Chinese initiatives is to produce museum-based digital exhibits in order to increase visitor engagement [52].Another Chinese initiative in terms of cultural heritage preservation is that of the Qipao Virtual Museum and Digital Library, which aims to provide universal and dynamic accessibility. The virtual museum was designed based on the principles of digital libraries and Web 2.0 technologies [15].

In Singapore, the dissemination of historical and cultural knowledge through innovation became part of the transition to a smart nation. Singapore's achievements in this area include two interactive digital platforms run by the state: the National Library's online archive The Singapore Memory Project and the National Museum's art installation The Story of the Forest [53]. The Smithsonian's National Museum of African American History and Culture based in Washington D.C. designed a program that creates digital collection records and surrogates. This program improves collection care and meaning, as well as accessibility. Besides the program, the museum has a specialized team in charge of digitization, with well-established resources and supporting departments [54]

In Italy, Naples, a temporary art exhibition of sculptures placed in the Maschio Angioino Castle was conceived as a smart museum based on IoT architecture. The latter would transform the static cultural space into an intelligent space using an innovative model of sensors and services [22]. Another Italian initiative took the shape of MUS.AQ digital museum of L'Aquila, which used advanced ICT to enable the interpretation and presentation of cultural heritage. It used digital and interactive applications to document, preserve and experience architecture and urban space [55]. The National Cinema Museum of Turin uses ICT to improve the visiting experience, including for the visually impaired. The infrastructure comprises: free Wi-Fi network, digital captions on tablets with backlit touch displays, mobile TAGs, NFC proximity technology, 270 degrees circular screen [35]. MuseoTorino is a good practice example of ubiquitous museum, which ''can be enabled, accessed, experienced, and shared by different technologies and communities of users both in person and remotely [7].'' It was proposed to explore and manage Single Smart spaces, such as indoor museums, archaeological sites, historical archives, etc., using a system based on a Service Oriented Architecture providing context-aware applications. The results were obtained within another Italian initiative, DATABENC, which aims at achieving a High Technology District for Cultural Heritage Management in Campania [56].Florence is another Italian city in which researchers designed an innovative mobile application, ''Once Upon a Time'' Magic GLASS, to be used in discovering and valorizing the urban cultural heritage. The application treated the city as an outdoor virtual museum and it used the digital images kept at the National Central Library of Florence ''to provide an immersive experience to the users'' and exploit preserved digital objects [57]. The proposal to use IoT in order to personalize museum visits was validated in the MUST museum in Lecce. A non-invasive indoor location-aware architecture was used to enhance the user experience in the museum. The system can be used from smartphones or wearable devices to retrieve the desired cultural content [38], [58].

The Museum of Anatomy at the University of Glasgow implemented an ICT-based methodology combining photogrammetry, object virtual reality (VR) and interactive portable document format (PDF) [59]. The Herbert Museum in Coventry, UK, provides immersive 3D experiences that mix the real and the virtual world using VR [37].

In Belgium, digitization of federal collections took place at the Royal Belgian Institute of Natural Sciences in Brussels and at the Royal Museum for Central Africa in Tervuren. The former adopted a 3D virtual museum model and focus stacking of type specimens, whereas the latter digitized collections in 2D or 3D models [15].

Online accessibility and usability of digital content of GLAMs are two of the priorities of the Finnish National Digital Library. Researchers proposed a set of instructions and a template mapping of the Lightweight Information Describing Objects (LIDO) XML national schema. The schema uniformly presents heterogeneous data, making various actions easier, e.g. retrieval, browsing, versatile linking between object types or data fields [60].

In Romania, VR was applied in the field of cultural heritage, by reconstructing 3D virtual models of real cultural artefacts and items kept by Brasov History Museum. The virtual models are obtained from a 3D scanning system operating on the laser striping principle. The online presence of these models is argued to bring about a higher accessibility and availability for scientists, researchers, and users. The process would also contribute to a better preservation of cultural artefacts as a digital archive of these 3D representations was created [45].

In the context of ongoing digitization, a group of international experts proposed the People's Smart Sculpture PS2-Social Art in European Spaces. The project included, *inter alia,*museums and galleries from eight European countries, and managed to organize eleven labs integrating new art, design thinking, smart technologies, and user culture with the purpose of designing new forms of participation for smart cities. City sustainability and creative articulation are tackled in conjunction. Thus, urban development, digital media, ICT, and art are seen as part of a larger coherent process. The stakeholders of this process are the citizens, creatives, artists, and governments. [61].

Digitization of field documentation in archaeology, i.e. text, photographs and drawings, is of utmost importance given that such items are susceptible to degradation.

Digitization would then ensure better storage and archiving for preservation and availability purposes, both for researchers and visitors. Steps in this regard have been taken by the Archaeological Museum in Zagreb, by proposing a clear model for digitization and coherent database for organization and archiving [62].

Another digital solution for data collection, processing and dissemination in archaeology took the shape of the ArchField methodology, which translates field excavations into real-time virtual museums. It basically creates online maps through the excavation period. The methodology is interoperable with various GIS viewers and data storage is based on an online PostGIS database. The researchers having produced this methodology argue that it facilitates standardization, diminishes redundancy, enables storage, and provides immediate online access [63].

Some of the most visited museums in Turkey, Topkapi Palace, the Blue Mosque, the Museum of Anatolian Civilizations, Mevlana Museum, Istanbul Modern, benefit from official websites allowing virtual tours [64].

V. PUBLIC POLICY DOCUMENTS PROMOTING SMART CULTURE AND IMPROVING ACCESSIBILITY AND INCLUSION FOR MEMORY INSTITUTIONS

Smartening up culture through adequate public policies is a current local, national and regional concern in an endeavor to ensure better accessibility and inclusion. It has been earlier argued that, if properly implemented, cultural technologies have the capacity to reduce costs, time and distance associated with cultural experience for the general public. In addition to addressing the needs of the general public, such technologies may sometimes be the only means of access to culture to the more vulnerable categories of population, such as citizens with sensory and mental impairments or with mobility issues. In addition, better access to culture lays the foundations for promoting intercultural dialogue and international cooperation, and seeks to achieve cultural sustainability, i.e. providing access to cultural content to the current generation without imperiling the ability of future generations to have access to it, through preservation and maintenance of cultural content.

In addition to UNESCO's Universal Declaration on Cultural Diversity (2001) [2] and Convention on the Protection and Promotion of the Diversity of Cultural Expressions (2005) [3], the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) and the European Disability Strategy 2010-2020 both argue for cultural accessibility, which is mainly seen as a set of obligations to ensure access to cultural goods and services [65]. Hence, the need to prioritize actions that enable the transition towards smart and inclusive culture is urgent.

Preservation of, and access to the European cultural heritage through digitization stand out as priorities on the European agenda. Digitization is one of the European objectives included in the Europe 2020 Strategy [66]. The latter provides the creation of a Digital Agenda for Europe in order to achieve the Digital Single Market.

The current European objectives are in line with the digital society evolution. According to the European Commission, the European Union (EU) is still falling behind in terms of Internet speed and online dissemination of knowledge and online distribution of goods and services compared to other parts of the world. This is the reason why immediate action is recommended, including in the cultural field [66].

The EU Digital Single Market addresses this broader need, as follows: "borderless and safe EU web services and digital content markets, with high levels of trust and confidence, a balanced regulatory framework with clear rights regimes, the fostering of multi-territorial licenses, adequate protection and remuneration for rights holders and active support for the digitization of Europe's rich cultural heritage, and to shape the global governance of the internet [66]." The Commission considers this to be an achievable target due to, among others, the talent and creativity of people, the cultural diversity, and solidarity that Europe benefits from.

According to the Digital Agenda for Europe, digitizing Europe's cultural heritage is this generation's duty in order to make it available to present and future generations [67]. Through digitization of cultural content, improved accessibility will be ensured, along with a better flow of data and knowledge, and more learning opportunities. This was planned to be achieved through a digital library, called Europeana. A unique European library is argued to have a huge economic, social, and cultural potential to increase the European competitiveness.

The European Commission recommended the creation of the EDL back in 2011, and its implementation is mentioned on the Digital Agenda [46]. Its main purposes are the digitization and preservation of Europe's cultural memory, which includes: print, photographs, museum objects, archival documents, sound and audiovisual material, monuments and archaeological sites, i.e. cultural material. Subsequently, online cultural material can be accessed and used for various learning, professional or leisure purposes. It can also be used to create economic and business opportunities, which will in turn contribute to a smart sustainable inclusive economic growth and well-being. Digital content is credited with the capacity to create positive spill-over effects upon the whole economy and society, and this is the main rationale for the stake of consolidating Europeana.

Previous European Commission recommendations and Council conclusions had referred to the creation of digital libraries in each EU member state [68], [69]. The purpose of national digital libraries is, on one hand to preserve and protect national heritage, and on the other hand to promote national cultures abroad through improved access.

As of 2019, only 10% of the European cultural heritage was digitized. However, given the vulnerability of cultural material, as well as the growing importance of the cultural sector (there are 8.7 million jobs in cultural-creative industries, 12.8 billion EUR is the trade surplus in cultural goods

in the EU, and 5.3% of the EU gross domestic product comes from this area), the European Commission has identified further opportunities in emerging technologies: 3D, big data, artificial intelligence (AI), VR, AR, and 5G [70].

In the light thereof, the EU member states adhered to the Declaration of Cooperation on Advancing the Digitization of Cultural Heritage. The main priorities stated in the declaration are: fostering a pan-European initiative for 3D digitization of cultural heritage, encouraging re-use of digitized cultural resources in order to create spill-over effects in other industries and foster citizen engagement, and encouraging cross-border and cross-sector cooperation [70]. Thus, Europeana is a result of digital transformations within the society and of the expanding digital ecosystem, but also a vector of further digitization, due to the existence of such initiatives. Because the whole process requires coordination, cooperation and concerted effort, a specialized group has been created to steer the digitization process, i.e. the European Commission's Expert Group on Digital Cultural Heritage and Europeana (DCHE). Also, specific financing tools have been created to this purpose: Horizon2020 and Connecting Europe Facility (CEF) [71].

Europe is not a remote initiative and example of good practice. Digitization has been initiated in the United States (US), too. As of 2017, 37.6% of libraries had concertedly engaged in digitization activities over the previous three years. Also, all state library have included digitization and provision of online access in their mission either explicitly (12.8%) or broadly (87.2%) [72].

Specific concerns regarding promotion of, and access to culture translated into public policy date back to the early 2000s. Over time, public efforts have moved from the simple pursuit of culture promotion and access provision to more complex objectives, which exceed the mere cultural sphere. Such objectives range from promoting cultural diversity and diversity of cultural expressions, protection of rights of persons with disabilities, broader access for all categories of population, going as far as looking at cross-border and cross-sector cooperation in the field of culture. Policy makers have understood that culture is not a stand-alone desideratum, but rather it is interconnected with other societal concerns, such as education, learning and knowledge preservation and dissemination, trade and business, citizen engagement and participation, as well as politics and international cooperation. This is because culture generates positive spill-overs onto the economy and society, and it is a soft power that can fade out barriers, help to resolve conflicts, and promote intercultural and intergenerational dialogue. In fact, recent public policy regarding culture and digital culture acknowledge the importance of ICT for the achievement of such objectives and concerns (3D, big data, AI, VR, AR, 5G, ubiquitous computing, digitization). Such technologies render cultural heritage and cultural material sustainable due to new preservation, archiving, and storage opportunities, which will ensure equal access to existing resources to present and future generations alike. Last but not least, policies supporting smart culture come to the fore as necessary in an increasingly multicultural, diverse, multilingual and multigenerational world.

VI. DIGITAL LIBRARIES – EXAMPLES OF GOOD PRACTICE FOR CULTURAL DIGITIZATION

Digital libraries are an adequate example of how digitization can be achieved in culture. The most important enterprises in terms of cultural digitization through digital libraries are the WDL and the EDL – Europeana. The former is a project of the US Library of Congress, established with the support of UNESCO, and in cooperation with libraries, archives, museums, educational institutions, and international organizations [73], whereas the latter is the result of a EU initiative.

The EDL is a Digital Service Infrastructure (DSI) for cultural heritage. It consists of a web collection of works belonging to a wide and varied range of cultural areas. The digital exhibition thereof is the result of initiatives stemming from cultural organizations, both public and private, in the EU member states. Europeana Collections provides access to over 57 million digitized cultural heritage objects from more than 3,700 institutions: libraries, museums, archives and audiovisual collections [74].

This section will analyze in an in-depth manner the European e-culture initiative by dint of Europeana statistics and relevant data related to cultural consumption and participation. To this purpose, we perform a comparative analysis and descriptive data analysis by country in order to answer the research questions detailed herein.

The analysis of the existing data for the areas under scrutiny within this research (Art, Photography, Manuscripts, Newspapers, Archaeology and Natural History), which were available as of November 2019, reveals that the best performing countries in terms of cultural digitization are the Netherlands, Germany, France, Austria, United Kingdom, Italy, Sweden, and Denmark. On the other hand, the countries with the poorest cultural digitization performance are: Cyprus, Bulgaria, Romania, Malta, Slovenia, and Portugal (Table 2).

The main research question is how these differences among the EU countries can be explained and how they can be related to well-being.

A possible explanation for large differences could be provided by the different levels of ICT integration in the economy and society. Thus, according to DESI, Sweden, the Netherlands, Denmark, and the United Kingdom are among the best performing countries in terms of adopting digital technologies in economic and social processes (Fig. 2).

As concerns the poorest performances, we conclude that Romania and Bulgaria have the lowest DESI scores of all the EU-28 countries. Nevertheless, DESI cannot and does not entirely explain the poor cultural digitization performance of certain countries, such as Malta and Slovenia. In these specific cases, DESI scores are higher than the DESI scores of some of the best performing countries in terms of cultural digitization (e.g. Germany, France, Italy). Despite this,

TABLE 2. Number of objects digitized and included in Europeana by country, by type.

	Art	Photo-graphy	Manu-scripts	News-papers	Archae-ology	Natural history
AT	127154	217291	2759	801991	629	201021
BE	107413	21071	2127	12255	18319	96184
BG	3850	2700	5	416	2135	21
HR	13104	11738	6	18003	37	62
CY	1276	1468	141	3	1355	7
CZ	3926	3441	76285	4	251547	8344
DK	91360	254798	2726	n/a	129612	24468
EE	14	4050	23	92659	11984	71773
FI	20682	34539	n/a	539628	4416	47489
FR	424653	208737	77807	446808	77952	508101
DE	354234	1256712	24257	389448	108480	215603
EL	45550	147425	410	4422	10301	2630
HU	90327	73062	517	26	11602	7803
IE	477	2255	1084	1	15075	469
IT	98141	195870	31123	4419	4710	103725
LV	638	41252	53	69760	n/a	273
LT	23979	60088	n/a	14	40429	1464
LU	9	n/a	n/a	65590	n/a	n/a
MT	908	50345	4	n/a	2140	7
NL	488716	557497	39648	748152	575439	4551056
PL	46547	91859	6053	320877	1670	11434
PT	28178	2830	32630	93	4144	62
RO	8934	8152	270	770	9890	227
SK	3535	268	5	n/a	n/a	6458
SI	1752	27257	63	187242	7671	21
ES	165438	448157	13830	480837	29631	8596
SE	268186	874103	353	n/a	682320	15781
UK	383827	40496	117227	133912	59304	2485400
EU	2802808	4637461	429406	4317330	2060792	8368479
EUR	68629	24340	36577	1	56046	14380
US	282065	1462	2563	n/a	230	119854

Source: Author's compilation based on the data provided by Europeana Collections [26]

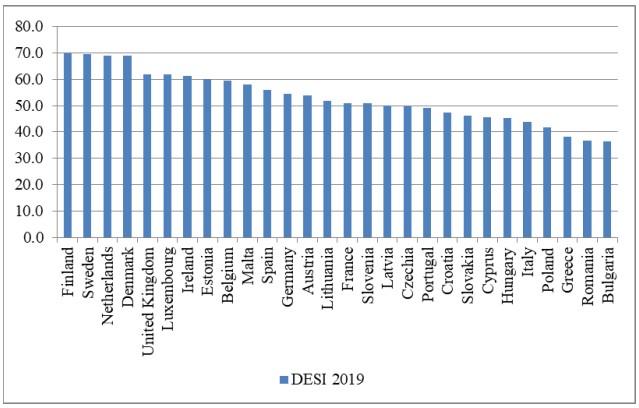

FIGURE 2. DESI scores for EU-28 countries, 2019 [47].

the contributions to Europeana of the cultural organizations within these countries are meagre.

This means that explanations could take the form of other types of motivations to digitize cultural heritage. Therefore, subsequent research questions are needed in order to explain the different levels of cultural digitization. One of these questions is how online cultural purchases can be related to the differences in Europeana. Such data are closer and better connected to the specificity of the data within the Europeana Collections. In order to find an answer, we looked into the larger e-culture area, more precisely into online purchases of books/magazines/newspapers. It can be noticed that in the countries with the best performances in cultural digitization, citizens also express a high level of interest for cultural products purchased online. With few exceptions, the positive relationship between online cultural purchases and cultural digitization is also confirmed for countries that perform worse in the process of cultural heritage digitization (Table 3).

The data above reveal that in the Netherlands, Germany, Sweden and UK, more than 30% of the individuals who used internet within the last year online purchased cultural goods and services. France, Austria and Denmark are the only exceptions. The relationship is also obvious for countries with poorer performances. In Bulgaria, Romania, and Cyprus, the percentage of those who purchased online books/magazines/newspapers is below 5%. In Slovenia and Portugal, the percentages are a little bit above 10%.

An additional research question is how cultural spending is responsible for the levels of cultural digitization. Finding an answer to this particular question can also serve as a relevant indicator for the relationship well-being-cultural digitization. To this purpose we used data concerning the mean consumption expenditure of private households on cultural goods and services. We expect that in countries with high living standards the value of mean consumption expenditure of private households on cultural goods and services to be high. By the same reasoning, we also expect cultural NGOs financing to be high, including that of NGOs providing cultural services in the area of cultural heritage digitization and indexation. As a consequence, we could anticipate the existence of a positive influence of the mean consumption expenditure of private households on cultural goods and services on the performance of EU-28 countries in the cultural digitization process. As can be noticed in Fig. 3, the countries in which private households spend the higher amounts on cultural goods and services are Sweden, Germany, UK, and Austria. These are also among the best performing countries in terms of cultural digitization. By contrast, in Bulgaria and Romania, private

TABLE 3. Online purchases: books/magazines/newspapers.

	2015	2016	2017	2018
EU28	22	22	23	22
Belgium	18	20	22	16
Bulgaria	4	2	2	2
Czechia	9	10	9	9
Denmark	22	26	28	29
Germany	34	34	38	33
Estonia	20	17	16	18
Ireland	22	21	18	21
Greece	6	5	6	6
Spain	12	13	14	15
France	21	21	21	21
Croatia	6	8	3	3
Italy	10	10	11	12
Cyprus	5	5	3	4
Latvia	4	5	5	4
Lithuania	5	6	8	9
Luxembourg	43	50	57	28
Hungary	13	12	11	13
Malta	24	18	22	21
Netherlands	33	34	35	36
Austria	32	29	27	26
Poland	11	13	13	12
Portugal	14	11	12	11
Romania	4	4	3	5
Slovenia	6	8	8	8
Slovakia	15	15	12	14
Finland	22	21	25	26
Sweden	30	30	33	37
UK	36	34	36	35

Source: Eurostat [48]

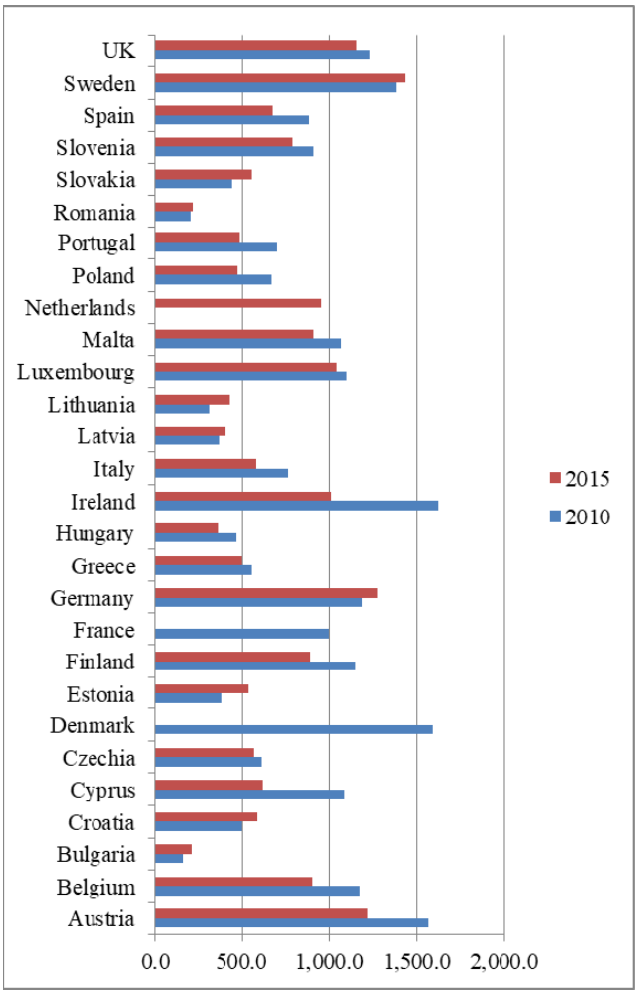

FIGURE 3. Mean consumption expenditure of private households on cultural goods and services, 2010, 2015 (purchasing power standard (PPS) [49].

households spend the lowest amounts on cultural goods and services.

The data above reflecting the propensity towards spending on cultural goods and services could explain the differences among countries in terms of cultural heritage digitization, both due to differences in private financial resources allocated to this purpose and due to the differences in citizens' interest for cultural activities. It is to be expected that cultural NGOs benefit from private financing and use it for achieving cultural heritage digitization to a higher extent in wealthier countries. In such cases, private resources could be directed towards e-culture.

In addition, another research question arises: besides the availability of financing sources and resources, are the initiatives towards cultural digitization encouraged by the high interest for cultural activities shown by the public? More specifically, investigating a possible connection between cultural consumption and e-culture initiatives may provide useful insights concerning the main research question. In order to find an answer we used the frequency of participation in cultural sites data. It is to be expected that cultural heritage digitization initiatives are spurred in countries in which the frequency of participation in cultural sites (historical monuments, museums, art galleries or archaeological sites) reaches high levels (Fig. 4).

It can be noticed that the best performing countries in cultural digitization also have high values for cultural consumption. In the Netherlands, Sweden, UK, Denmark, and Finland, the frequency of participation in cultural sites (historical monuments, museums, art galleries or archaeological sites) is consistently above 50% for the last year. There is a poor level of engagement and interest for cultural participation, as expressed by the frequency of participation in cultural sites (historical monuments, museums, art galleries or archaeological sites) in the countries with the poorest performance in cultural digitization: Bulgaria, Romania, Cyprus,

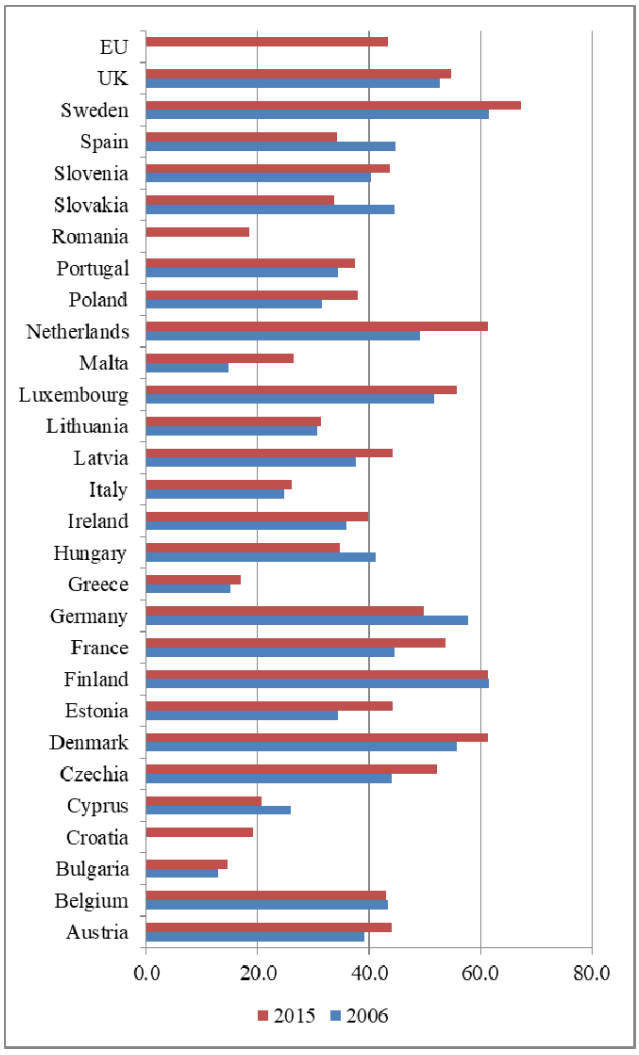

FIGURE 4. Frequency of participation in cultural sites (historical monuments, museums, art galleries or archaeological sites), 2006, 2015 [50].

Malta, and Greece. Moreover, we can also notice correlations between the frequency of participation in cultural sites (historical monuments, museums, art galleries or archaeological sites) and the countries' performance in cultural digitization in the following fields: Natural History, Archaeology, and Art. To exemplify, Romania has the poorest performance in the digitization process for Natural History, and Bulgaria and Cyprus have poorer performances than for Natural History only for Manuscripts and Newspapers. Cyprus, too, has one of the poorest performances in the digitization in Archaeology, and it occupies the last position, sharing it with Malta, in Natural History digitization. Malta has the weakest results in cultural digitization for Natural History (the last country among the EU-28 countries) and Art (the last country among the worst performing countries). A special case is that of Greece, in which the frequency of participation in cultural sites (historical monuments, museums, art galleries or archaeological sites) is among the lowest in Europe, despite its distinguished cultural heritage. It is no coincidence that the poorest performances in cultural digitization are for Natural History and Archaeology.

TABLE 4. Cultural participation & attractiveness in cultural cities of the EU, 2017, 2019.

Cities	2017	2019
Amsterdam	41.40	40.73
Barcelona	30.26	31.33
Berlin	41.39	40.83
Birmingham	21.80	23.69
Brussels	24.10	23.91
Bucharest	15.67	16.57
Budapest	25.44	27.95
Cologne	30.43	29.96
Copenhagen	54.39	54.39
Hamburg	28.91	28.93
London	29.16	29.18
Lyon	27.80	27.62
Madrid	22.32	23.27
Milan	42.19	40.64
Munich	42.84	42.19
Paris	55.28	54.43
Prague	33.54	33.28
Rome	31.96	34.95
Sofia	8.14	8.34
Stockholm	53.68	50.52
Vienna	52.38	52.17
Warsaw	24.67	24.67

Source: European Commission [51]

In addition to the main research question we analyzed the relationship between well-being and interest for cultural activities or cultural consumption. In order to do this we used the data on Cultural and Creative Cities Monitor, more precisely on Cultural Participation & Attractiveness. The existing data disclose the most cultural cities, by number of inhabitants, in the EU-28 countries. As can be noticed, the cities with the highest scores for Cultural Participation & Attractiveness (Paris, Copenhagen, Vienna, Munich, Berlin, Amsterdam, Milan) belong to countries whose performances in cultural digitization are among the highest. At the other end of the stick are the cities with the largest number of inhabitants in Romania and Bulgaria (Table 4).

VII. DISCUSSION AND CONCLUSION

From the descriptive analysis of the existing statistics on e-culture we conclude that cultural digitization is an uneven process across countries, and that several explanations can be provided in this respect. One explanation would be that ICT integration in the economy and society is not even, either. Moreover, demand for and consumption of cultural goods and services vary significantly across countries. We observe that there is a positive correlation between cultural digitization and online purchases of cultural goods and services, on one hand, and between cultural digitization and consumption expenditure, on the other hand. Another positive correlation has been found between cultural participation and cultural digitization. In other words, countries in which cultural consumption is at a high level have also reached a higher degree of cultural digitization as compared to other countries.

Interest for culture is particularly high in those countries in which standards of living are higher. By contrast, poorer countries experience a lower level of interest for cultural activities. The hypothesis is also tested in the case of cities. Thus, cities with the highest values for Cultural Participation & Attractiveness are among the best performing countries in cultural digitization. We have, therefore, found that cultural consumption is positively correlated with the degree of cultural digitization, and that cultural digitization goes hand in hand with citizens' well-being.

Uneven cultural digitization reflects uneven levels of digitization in general, as expressed by DESI, and uneven levels of well-being. Thus, wealthier countries have better performances in this respect, whereas poorer countries lag behind. This is mainly because this process is costly and requires specialized staff, which implies additional resources. Another reason for differences among is the lack or insufficiency of long-term public-private partnerships to fund this process [44]–[46]. We argue that there is a vicious cycle: a poor performance in cultural digitization (and digitization in general) could, in turn, have adverse consequences in terms of citizen's well-being – lagging behind will only lead to larger development gaps between countries, and citizens will benefit from relatively poorer cultural services compared to the better performing countries.

Smart culture has positive effects on three layers: personal, industry and society. On a personal level, smart culture enables improved and personalized cultural experience [37], [38]. Time, cost and distance barriers are lower or disappear [29], [30]. In addition, smart culture is more inclusive for vulnerable categories of citizens [12], [21], [34], [36].

From an industry standpoint, smart culture helps to preserve, protect, and promote cultural heritage [28]. Therefore, citizens' participation and engagement are encouraged and cultural consumption increases [70].

Social and economic positive spill-over effects of smart culture include: new learning and business opportunities, increased economic competitiveness [18]–[21], [46]. Besides, smart culture addresses sustainability concerns, as it provides presents and future generations with more cultural, educational, and economic opportunities due to better preservation and storage [42].

The main research limitation encountered is the lack of harmonized reporting on cultural digitization initiatives and programs. Also, data reported on EDL and WDL do not follow the same methodology, which makes it difficult to compare country achievements across the two digital platforms. Moreover, data on WDL cannot be handled as in the case of EDL due to different sorting and filtering options. In addition, data on DESI, cultural digitization and other indicators regarding e-culture is not collected and reported on an annual, nor on a frequent basis. This makes quantitative research difficult to conduct. Another research limitation is that there are no additional variables or factors that include segments of the population by age insofar as cultural consumption is concerned. Last but not least, being in an early stage of development, cultural digitization is difficult to assess in dynamics.

Smart culture is important from a multidisciplinary research point of view, which could be further conducted in several areas: investigating citizens' consumer satisfaction, analyzing lowering transaction costs associated with smart cultural consumption, chronological analysis of digitization, legal considerations of cultural digitization, and cost-benefit analysis in implementing IoCT.

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