Information and Communication Technologies and Communicational Approaches for the Dissemination, Preservation, Understanding, and Attractiveness of Cultural Heritage

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Abstract The enhancement and promotion of cultural heritage through the adoption of Information and Communication Technologies (ICTs) represent today some of the most important research issues with a wide variety of potential applications. In the current context, technologies and social media become strong allies for places that need to promote the most remarkable aspects of their cultures to attract visitors and, consequently, stimulate their economies. The aim of this paper is to analyze what kind of information technologies and communication approaches are used, as well as their purpose in a time span of 10 years. Additionally, it is intended to understand how these tools are evolving and to understand their current direction. The methodology used in this paper will be the analysis of 22 articles from a total selection of 58 articles. From the analysis of the collected data, we understand that over the last decade the technologies to be used in the context of cultural heritage have been diversified, highlighting social networks and augmented reality being the digital approaches with more trend. Additionally, it was verified that the ICTs analyzed had as main purpose the promotion of cultural heritage. Concluding that the evolution is governed by the trends, so there is a need for readjustment so that visitors and communities have interest in cultural heritage.

Keywords Information technologies · Cultural heritage · Communication · Dissemination · Preservation

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1 Introduction

More and more attention has been paid to the participatory approach to culture and heritage management in recent times [1]. Internationally qualified people have paid more attention to the variety of cultural expressions, agreeing that the assimilation of cultural diversity is the focus to ensure an efficient and sustainable connection between a society and its heritage [2].

In this way, accessibility becomes a concept to be considered, since the accessibility of all interested parties to a certain site is essential for cultural heritage [3]. It is important to emphasize that something becomes heritage when the population propagates certain values. Thus, accessibility becomes crucial for a place to become heritage [4] and ensuring public accessibility to cultural heritage sites should be a prerequisite for any site that wishes to be recognized as cultural heritage. One way to ensure this accessibility is through information and communication technologies, making information easily accessible.

In recent years, several investigations have focused on improving the cultural heritage tourism experience, at different scales, by exploring the opportunities of using information and communication technologies [5]. According to Bolchini et al. [6], the use of information and communication technologies has dramatically changed the way cultural heritage is displayed. If on the one hand, tourists used to see the information presented in a static way with a large amount of "cultural signs," on the other hand, the new services are characterized by being personalized, since the visitors' interests are considered, along with context information [7].

"The digital revolution is leading to new and innovative forms of artistic creation while making culture and heritage more accessible and opening up new ways of enjoying cultural contents. Making our cultural heritage widely available in the digital era is vital" [8]. Today, digital transformation is one of the most common and important phenomena. In parallel, the increasing attention to cultural heritage as a basic driving force for social cohesion, economic growth, and sustainability has encouraged the development of knowledge, dissemination, reuse, protection, and knowledge enhancement of cross-border cultural heritage [8].

According to the conclusions practiced by the Council of Europe in 2014, European policies have propitiated cultural heritage as "a strategic resource for a sustainable Europe." [9]. Therefore, the European Union encourages research, development, and promotion of all means necessary to provide economic growth, social cohesion, and a sustainable environment for intangible and tangible cultural heritage, which led to the European Union initiative highlighting the role of the development of new digital technologies and the process of digitization. Digital heritage is needed to register and protect European heritage, increase its visibility and accessibility, involve local communities, and support the impact on cross-cutting areas such as education, tourism, creative, and cultural industries [8].

The paper is based on desk research through the analysis of 58 scientific articles with the following objectives: analyze the current uses of digital and communication technologies applied to cultural heritage. The identification of the most used methods

enables the improvement and preservation of cultural heritage, whether it is tangible or intangible nature [10]. Another objective will be to focus on the purpose of the technological and communicational means found in the different articles collected, to have an idea of the main application of a particular technological approach. Finally, and to support the 10-year interval research, the evolution of the use of technologies for the promotion of cultural heritage will be analyzed.

2 Digital Approaches for Cultural Heritage Collaboration

Cases such as co-production, e-education, digital archiving, or location-based games have been studied, as ICT and communicational approaches have encouraged this connection to society and the use of co-collaboration in urban planning and heritage conservation [11, 12].

User experience can also be a way to collaborate with cultural heritage. It can be used on travel equipment to create a digital system that provides useful services and information from different sources, from text descriptions to images and videos, and can give you the opportunity to enjoy multimedia stories told in real time [7].

The availability of innovative tools based on 3D models, such as Virtual Reality (VR), Mixed Reality (MR), and Augmented Reality (AR), opens innovative scenarios for cultural heritage. 3D models can be used for both documentation and control, but also for digital applications such as virtual tours, virtual tourism, and digital reconstructions, as well as for diagnosis, conservation, and management measures [8].

Social media also contribute significantly to the collective memory of the community [13]. The eagerness to get important information in the moment and participation in planning inspires people and, consequently, leads to a great potential for involvement in both the use of the media and the connection to cultural heritage [14].

3 Methodology

The present research was conducted, hoping to understand which information and communication technologies are used for the promotion of cultural heritage, as well as their purpose. Additionally, it is also intended to analyze the evolution of these technological forms in a period of 10 years. It should be noted that the purposes envisaged have to do with dissemination, preservation, help in understanding traditions, and attractiveness. In the case of attractiveness, the interactive medium, playability, and storytelling are considered.

Thus, the data collection was focused on the Scopus search engine. In this platform, a query was created with the words “Information and Communication Technology” in the Title, Abstract and Keywords; “Cultural Heritage” in the Title and with a

time interval between 2011 and 2021, so that 58 results were obtained at the bibliographic level. All the articles presented were read, emphasizing the abstract, that is, in this element we intended to answer the type of technology used and understand its purpose. However, if this approach did not provide enough information, the entire article was analyzed in detail. Of the 58 results analyzed, 22 articles demonstrated pertinent information for this research.

4 Results

After identifying relevant publications for the research, a stepwise review approach was used. The first stage refers to the analysis of the evolution of ICTs and types of technologies, i.e., the digital approaches implemented as a means of promoting heritage and cultural heritage. Thus, Table 1 presents the technologies exposed in chronological order, including the identification of the authors of the scientific papers.

As can be seen in the summary table, the use of ICT over time, for cultural promotion, has been quite diverse. It can be seen, in general, that technologies are used according to the trend of the moment, i.e., it is notable that in recent years the use of cell phones is predominant, so the technologies created are directed so that the user can see whenever and wherever he wants. Thus, between the years 2021 and 2019, the predominance of social networks, augmented reality, object detection, and QR codes is confirmed as current technologies that can be used via cell phones. Through Table 1, it is also possible to understand that there was, between 2019 and 2017, an evolution of technology through the change from 3D representation to augmented and virtual reality. This evolution is in line with what was previously mentioned, since it allows information to be on a device, discarding the need to handle physical objects.

The fact that technologies are trending does not make them less important or outdated, it is possible to verify the use of marketing and Web sites, between 2019 and 2014, as tools to promote cultural heritage throughout the decade, and these approaches are still used today. Finally, it is possible to conclude that between the years 2015 and 2011 the concept of interactivity was the trend of the moment, contemplating the projects such as Toolkit eLAICH and CheR Framework (history-puzzle) that are characterized by this component.

The second stage of analysis has to do with the technologies used for dissemination, preservation, understanding, and attractiveness of cultural heritage. Thus, it was decided to use the numbering of each of the articles in Table 1 and group by their common purpose, and it is possible that the same project integrates more than one purpose, as can be seen in Table 2. It should be noted that not all articles had the purpose that was previously decided; however, they were analyzed to understand what other types of purposes exist in the medium of ICT and cultural heritage.

To dissemination, 8 scientific articles were collected. The projects tend to highlight the most interesting and enjoyable views of historical sites as is the case of article 5. Another example of the purpose of dissemination concerns the promotion of cultural

Table 1 Types of digital approaches between the years 2021 and 2011

	Digital approach	Authors	Article year
1	Social networks	Xiaoxu Liang, Yanjun Lu, and John Martin	2021
2	Database (for cataloging)	Adriana Marra and Giovanni Fabbrocino	2020
3	Augmented reality	Teresa Graziano and Donatella Privitera	2020
4	3D Representation	Claudia Di Benedetto, Antonio Gautiero, Vincenza Guarino, Vincenzo Allocca, Pantaleone De Vita, Vincenzo Morra, Piergiulio Cappelletti, and Domenico Calcaterra	2020
5	Object detection and QR code	Fabrizio Balducci, Paolo Buono, Giuseppe Desolda, Donato Impedovo, and Antonio Piccinno	2020
6	Game (game based learning)	Marijana Cosović and Belma Ramic-Brkić	2020
7	Augmented reality and virtual reality	Alice Paladini, Abhijit Dhanda, Miguel Reina Ortiz, Adam Weigert, Eslam Nofal, A. Min, M. Gyi, S. Su, Koen Van Balen, and Mario Santana Quintero	2019
8	Augmented reality	A. Malliri1, K. Siountri, E. Skondras, D. D. Vergados, and C.-N. Anagnostopoulos	2019
9	Web sites	Valeriano Piñeiro-Naval and Paulo Serra	2019
10	Apps, social communication and marketing	Ermelinda Kordha, Klodiana Gorica, and Kozeta Sevrani	2019
11	Virtual exhibitions	Cristian Ciurea and Florin Gheorghe Filip	2019
12	Marketing	Mara Cerquetti and Concetta Ferrara	2018
13	Marketing	Mara Cerquetti	2018
14	3D representation printed	Plamen Zahariev, Georgi Hristov, Nina Bencheva, Mihail Iliev, and Yoana Ruseva	2017
15	SCRABS prototype (multimedia collection)	Flora Amato, Vincenzo Moscato, and Antonio Picariello	2017
16	Mobile application	Eduardo Merino and Claudia Zapaata	2017
17	Multimedia recommendation platform	Ilaria Bartolini, Vincenzo Moscato, Ruggero G. Pensa, Antonio Penta, Antonio Picariello, Carlo Sansone, and Maria Luisa Sapino	2016

(continued)

Table 1 (continued)

	Digital approach	Authors	Article year
18	Interactive app	Francesco Longo, Letizia Nicoletti, G. Florio, M. Vetrano, L. Bruno, and Lorenzo Caputi	2015
19	Monitoring network	Leonarda Carnimeo, Dora Foti, and Salvador Ivorra	2014
20	Interactive Web site	Sabine Marschall	2014
21	eLAICH toolkit	Anna Lobovikov-Katz, Agoritsa Konstanti, Kyriakos Labropoulos, A. Moropoulou, Joann Cassar, and Roberta De Angelis	2012
22	CheR framework (history-puzzle)	Carmelo Ardito, Paolo Buono, and Maria F. Costabile	2011

The reference of the articles present in the table below can be found at: https://drive.google.com/file/d/1bhvEJjVqVYnd5rUHPcQ2EJ6w-S7IthFp/view?usp=sharing

Table 2 Distribution of the articles by their purpose

Purpose	Digital approaches
Divulgation	3, 4, 5, 6, 9, 11, 16, 21
Preservation	2, 8, 12, 19, 20
Understanding (traditions and space)	4, 5, 7, 14, 15, 18
Attractiveness (interaction, gameplay, storytelling)	5,17

heritage to make users aware of its importance and motivate them to visit more often cultural institutions such as museums, this purpose being taken from article 6. Also, the promotion and enhancement of the physical objects of cultural heritage are considered, this purpose belonging to article 11.

In the case of preservation as a purpose, 5 scientific articles were grouped together. Being the purposes similar among them, the conservation of memory and information of sites is highlighted, being this application important for cultural heritage, highlighted in article 8; also, the preventive maintenance of historical centers from early warnings, present in article 19, is to be highlighted for the preservation of heritage and cultural heritage.

In terms of understanding, both the historical component and the cultural heritage sites, 6 articles were collected. The highlight of the promotion of knowledge, in this case through 3D reconstruction is present in article 4; accessibility to knowledge and consequently, a better understanding of cultural value, is also one of the purposes that integrate understanding, highlighted in article 7. The contextualization of cultural environments displayed in article 15, belongs in the purpose belonging to the understanding of cultural heritage.

Regarding the attractiveness of the two selected articles, the attempt to make visits to historical sites more interesting and enjoyable is highlighted in the case of article

5. Also highlighted is the provision to tourists of useful personalized and dynamic visiting routes, to make the visiting experience more stimulating and interesting as is the case in article 17.

As mentioned above, not all articles were grouped by the previously defined purposes. Thus, it is possible to conclude that besides dissemination, preservation, understanding, and attractiveness, there are other important purposes such as community involvement and public participation (1); enhancing the digitalization of cultural heritage for a more sustainable tourism (10); extending the value of museum experiences (13); increasing awareness of the importance of cultural heritage (21); and supporting the visit to cultural heritage sites (22).

5 Conclusions

Today, society is tending to take advantage of technology and the use of digital approaches to engage the community and to promote and disseminate cultural heritage values, and this is increasingly being considered. Digital technologies can improve means of conservation and preservation, enrich existing archives, enhance participatory experiences, promote communication among stakeholders, and deepen understanding and attachment to culture [15].

This research aimed to analyze the types of ICT applied to cultural heritage, their purposes, and how their evolution is characterized in a period of 10 years. When analyzing the 22 articles, it was possible to conclude that over the last years there have been several technologies implemented with the purpose of involving the community in cultural heritage. It is noteworthy that this variety is subject to trends, i.e., evolution is characterized by being biased, since society changes over time. With each transformation, i.e., trend, new identities, contexts, and objects are generated. In this way, heritage adapts itself so that future generations can make use of the knowledge, experiences, and traditions of a previous era [16]. It is verified that currently Social Networks and Augmented Reality are technologies that are at the forefront, leaving aside, over time, multimedia platforms, apps, and interactive Web sites. In terms of the purposes of these technologies, disclosure stands out as the main purpose of the ICTs analyzed, and these technological approaches intend to disseminate the cultural heritage, motivating the community and interested parties to visit places added to the cultural heritage. It is also important to note that in addition to the purposes previously decided for analysis, it was possible to see that there are technologies with different purposes that are also important for heritage and cultural heritage, such as raising awareness and extending the value of museums, for example. Technological initiatives restore the cultural identity of a place, bringing the community together and facilitating the dissemination of different cultures. Consequently, it increases tourism and the social and economic development of the region [16].

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