Smart fruition of archaeological heritage:
evidence from great cultural attractors

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Abstract

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1 - Introduction

Digital transformation of services is nowadays a hot topic in the scientific debate, and scholars, practitioners, and institutions are giving attention to the digital transformation in cultural heritage (Cuomo et al., 2021; Li, 2020; Russo-Spena et al., 2021). Linkages between cultural heritage and territorial competitiveness is frequently investigated in studies on cultural tourism; indeed, innovative solutions and new value propositions in cultural heritage can also benefit from the deployment of other traditional in cultural tourism (Alvarez et al., 2010; D'Auria, 2014; Garau, 2017; Njovo and Makacha, 2018; Bigné and Decrop, 2019).

Furthermore, special interest is paid to the smart technologies and the adoption of digital devices to enhance visitors' experience allowing people to interact with the artworks (Cuomo et al., 2017; Christidou, 2018; Koutsabasis and Vosinakis, 2018). Indeed, intelligent initiatives through the application of technological tools lead to the creation of novel value proposition as well as new forms of fruition (Ciasullo et al., 2016; Li, 2020; Cuomo et al., 2021; Russo-Spena et al., 2021); these forms are more participative than in the past and based on opportunities of customization of the information flows and the experience itself, also favouring the improvement of territorial competitiveness and the strengthening of the local identity.

Digitalization is fundamentally changing the way cultural organizations shape their offerings and provide services; at the same time, digital technologies are now recognized as tools to enhance social value for the audiences and promote cross-cultural understanding, through the creation of new ways of interacting and sharing information among the different stakeholders (Rivero Moreno, 2018; Stromberg, 2013; Wang, 2014). The ICT-driven environment and the pluralistic features of culture highlight that the cultural heritage plays a crucial role in social changes, also introducing new social trends and desires.

However, culture innovation is not the same that innovation in culture, indeed, while the first concept highlights how the conception of culture is changing in the modern world and how the role of culture is transforming, innovation in culture implies the introduction and implementation of new tools and approaches leading to new and wider forms of fruition and interaction with the art pieces. In line with the above, Mars state that *"Cultural innovation is a term most often used by anthropologists and archaeologists to describe and interpret the technological occurrences that lead to human change. In other words, cultural innovation involves incremental or radical events that influence change and motivate progress at the community and/or society levels"* (Mars, 2013, p.14). Although the combination of innovation, art, and culture can favor the opening of new paths of use and, consequently, the approach of new targets, in some cases there's a risk that cultural resources are distorted.

In this scenario, the present study focuses on the digital transformation of the archaeological heritage, aiming at contributing to reduce a gap in the literature, since most of publications on digital transformation in cultural heritage focus on museums and events management (Charitonos et al., 2012; Jones, 2012; Koutsabasis and Vosinakis, 2018). To perform the investigation, we analyzed both theoretical contributions and practical evidence. First, we chose to pay attention to the theoretical side of both value proposition through digital initiatives and the digital engagement of visitors to enhance their experience (King et al., 2016; Mohd et al., 2020). Following, we focus on the digital solutions in archaeological heritage fruition, presenting some representative examples.

2 - Literature review

2.1 Value proposition through new technologies in cultural organizations

According to Aloini et al. (2021), value proposition is *"the mechanism through which the value created is offered to the market"* (Aloini et al., 2021, p. 3). Through a value proposition, a company promises to deliver value to customers derived from the usage of the product they choose to buy (Eggert et al., 2018). This aspect is crucial when defining the marketing strategy, as the satisfaction of customers is directly linked to their expectations when buying a product, and the expectations are also shaped by the company through the value proposition. New technologies are even more contributing to the configuration of firms' value proposition, as well as to the value production and delivery.

For instance, the value of Digital transformation comes precisely in its ability to transform the customer experience, as the focus is on the Value proposition aimed at obtaining a competitive advantage that can make the proposal different and more attractive not only for customers. The relationship between digitization and implementation of new technologies and innovative processes and the achievement of a competitive advantage is increasingly discussed.

In this regard, an interesting study by McKinsey (2016) highlighted the fact that companies with a strong propensity for innovation can be 23 times better at winning new customers, 6 times better at retaining their customers, and 19 times more adept at achieving positive results (McKinsey Global Institute, 2016). Such trends have elicited new forms of participation, innovation, and engagement, as well as methods of involving not only traditional visitors or users, but also multiple stakeholders, such as academia, industry, government, and other cultural organizations (Boiano et al., 2019).

New trends and new awareness have led to the definition of new forms of participation and involvement not only for visitors or customers, but for a multitude of actors from different scenarios, such as universities, institutions and companies. In this regard, Simon (2010) highlights the fact that, precisely because of their aptitude for greater innovation and the desire to involve their visitors more proactively, more and more museums are engaging in *"involving users to inform, co-design, and innovate projects and programs, as well as providing platforms for users to construct their own meanings with the institution"* (Boiano et al., 2019, p. 18). In addition to direct involvement, museums adopt different channels, for example internet and Direct mailing to communicate and update customers on the various initiatives proposed, so as to keep their interest high and establish constant contact with their public.

Furthermore, these forms of interaction help customers to understand the efforts of cultural enterprises in the establishment of social ties with all the actors that revolve around the company itself, with a consequent strengthening of both the image and the reputation. Indeed, interactive services *"have some form of customer-firm interaction in an environment characterized by any level of technology (i.e., a high or low technology environment)"* (Bolton and Saxena-lyer, 2009, p. 92), therefore, participation is fundamental otherwise it is not possible to deliver interactive services.

2.2 Value proposition and visitors' experience

In line with the above considerations, several studies on tourism and cultural heritage underline that those interactive services can favor pleasant touristic experiences (Dao & Yang, 2019). In their study published in 2016, King et al. identified a set of "key ways" through which cultural organizations can improve individuals' experience thanks to the digital technologies, namely (1), providing information to stimulate their attention and interest; (2) open up new areas and new collections also thanks to the digital fruition; (3) involving visitors asking for their feedback and interacting with them to shape the offering; (4) encourage the interactivity with the artworks.

To develop the activities above described, with particular reference to the interaction between visitors and pieces, many tools are now available for firms as tablets and interactive screens as movable interactive whiteboards, Mobile projectors, Portable audio equipment, Paper prototypes of digital interactions, Role Playing and gamification initiatives (Boiano et al., 2019).

Focusing on museums and on the way they interact with visitors to enhance their experience, *"the International Council of Museums (ICOM) identifies three different models of "digital museums": (i) the brochure museums, that is web pages designed to convey general information on the museum institution; (ii) the content museum, meaning digital databases devoted to museum collections; (iii) the virtual museum, or online platforms that stand out for the quality and variety of applications and digital content especially aimed at users, so as to guarantee a level of cultural enjoyment similar to the live experience"* (Palmi and Madaro, 2020, p.96). Same trends can be recognized in the Italian context, as, according to the Italian Ministry for Culture *"the use of digital technologies in museums is increasingly emerging as a valid method to increase audiences and engage visitors in the virtual, immersive and entertainment realities pertaining to their community. The latest museum trends involve 'User-Generated Content', 'Visitor-Generated Content', and*

'Crowd-Curated Exhibitions', as well as customized online collections, mobile tours, newsletters sent via email, and the participation to interest groups on social channels" (Palmi and Madaro, 2020, p.97).

2.3 Digital solutions in archaeological heritage fruition

Mobile devices are today considered as tools for organizations to provide customers with personalized services and, in the meanwhile, to shape marketing initiatives and offerings that can satisfy their target and attract new customers. In general, digital tools are mainly adopted in museums, however, new technologies are now being implemented in archaeological sites.

Indeed, in the last years, an increasingly widespread use of digital media and "virtual reality" has been detected in archaeological areas, a passage that *"mark(s) a new phase in the economic and cultural history of tourism"* (Costa and Melotti, 2012, p. 53). In regards, scholars as Howland and colleagues (2020) underline that, apart from the great potentials of the implementation of digital technologies in the archaeological areas, the implementation of multimedia technologies to create virtual reconstructions and 3D animations to popularize archaeology can determine the risk of distorting and denaturalizing the essence of the cultural heritage. Archaeologists and curators are often using virtual representations to make it attractive and enjoyable to a modern and more various target. Has to be underlined that new technologies have been used by archaeologists for a long time (Boast 2002), but mainly for scientific and academic purposes, as well as to produce digital version of site plans and artifact illustrations, thanks to valuable tools as Computer graphics through which representing and manipulating large amounts of complex data. In this regard, Evans and Daly highlight that the so-called Virtual (or digital) archaeology *"is a powerful tool for visualizing and understanding archaeological data as well as for producing and communicating it to the public"* (Evans and Daly 2006, p. 253). For examples, the re-creations of greatly detailed archaeological sites represent a very valuable resource for students in archaeology and heritage management, as ICTs and the Internet allow to detect and communicate archaeological knowledge to a broad community of researchers and specialists (Howland et al., 2020). Nowadays, it emerges that virtual images are used for multiple goals, namely, to share information, promote touristic sites, and communicate with tourists before, during, and after the visiting experience.

Furthermore, the implementation of digital technologies in archaeological areas can also represent a resource and a tool to create new forms of business in cultural heritage, as new technologies became channels that transforms the cultural places in scenarios where people can discover past realities. This means that *"the use of innovative tools for the enhanced use of museums and archaeological sites is extremely varied and reflects a plurality of needs and cultural orientations that demonstrate the essentially cultural difficulties with which archaeologists, administrators and professionals cooperate and tackle the relationships with the marketplace and tourism"* (Costa and Melotti, 2012, pp. 53-54).

Although is recognized that the new technologies can valorize archaeological heritage and enhance visitors experience, their employment is still scarcely organized and regulated, as coordinated policies and the sharing of best practices are still to be consolidated.

3 Aim and methodology

This paper aims to describe the effect of implementing new technology in archaeological areas. To select the examples, we used the list of the archaeological parks with special autonomy provided by the Italian Ministry of Culture. Then, we collected data through the official website of each organization, as well as from the Italian Ministry of Cultural official website and previous research. Finally, we chose to focus on representative initiatives for each cultural organization.

The increasing usage of mobile devices led tourism and cultural organizations to adopt digital tools and mobile applications to propose services through them. Studies – both theoretical and empirical – on mobile applications in the cultural context focus mostly on the advantages led by technology, the ways firms can benefit from them as it regards data, and the optimisation of operations. In line with this, our paper aims to

observe how new technologies can be used as tools for firms to propose enhanced visitors' experiences, as well as embedding local actors and visitors themselves.

As concerns the research process, this paper adopts an approach based on multiple case studies (Moorhouse, 2019), in order to observe practices and grasp data from them, leading to theorising (Eisenhardt, 1989).

Table 1 – The dataset

Museum	City
The National Archaeological Museum of Cagliari	Cagliari
The National Archaeological Museum of Naples	Napoli
The National Archaeological Museum of Reggio Calabria	Reggio Calabria
The National Archaeological Museum of Taranto	Taranto
The National Roman Museum	Roma
ETRU National Etruscan Museum of Villa Giulia	Roma
Regional Park of Campi Flegrei	Pozzuoli
Colosseum's Archaeological Park	Roma
The Appia Antica Regional Park	Roma
The Herculaneum archaeological site	Ercolano
The Archaeological Park of Ostia Antica	Ostia
The Archaeological Park of Paestum and Velia	Paestum
The Archaeological Park of Pompeii	Pompei
The Archaeological Park of Sybaris	Sibari

4 Results

Based on the premises above, we present a description of representative examples from Italy to highlight the role of technology in furthering and expanding the tourist offering through digital marketing tools.

The first example is represented by the *Archaelogical museum of Cagliari,* proposing the initiative "Saturday of virtual archeology". During these events, visitors can wear VR viewers and take an extraordinary journey travelling through Sardinia's history and prehistory. In detail, the visitor can "move" to various archaeological sites in Sardinia, such as Su Nuraxi di Barumini, Su Mulinu di Villanovafranca, Sa Sedda 'e sos Carros di Oliena and many others.

The *Archaeological Museum on Naples* (MANN) is one of the most representative examples of Italian museums implementing innovation-based initiatives. The Museum has started a complete redesign of its website, so that it can be used optimally from any device (PC, tablet, and smartphone). Furthermore, the Museum planned to develop procedures for sharing and updating digital contents, through which to convey a constant flow of information through scientific and cultural activities (events, workshops, seminars, events, exhibitions, etc.). At the same time, a digitalization campaign of the permanent collections of the Museum is going to be launched, both in 2D and in 3D, to improve the level of accessibility and allow people to see the artworkss in remote. The results of the digitization campaign will be progressively conveyed through the MANN website and the selected digital channels. In addition, the Museum also intends to explore new digital solutions, with particular attention to both Augmented Reality and Virtual Reality applications.

The *Archaeological Museum of Reggio Calabria* shows a particular commitment in making the museum's art pieces accessible to each category of visitors. Mobile devices are available to allow visitors with special needs to use the LIS VideoGuide (Italian Sign Language) through a multimedia system available, to overcome any barrier and improve the visiting experience. The texts intended for translation into sign language, for a total

of 120 videos, have been properly adapted for translation into LIS by professionals and experts in multimedia installations, and derived from the original ones by the archaeologists who collaborated with the museum.

The *National Archaeological Museum of Taranto* – MARTA – set up an innovative project named "MArTA 3.0". The project that intends to renew, integrate, and extend the cultural offer of the museum through the use of the most modern ICT technologies to relaunch the museum on the national and international level. Furthermore, the MArTA Lab means to create a new "participatory" museum experience, also adopting tools such as 3D printers and scanners, laser cutting machines and robotics kits, allowing visitors to create their own art piece. Therefore, the "Made In MARTA" products are one of the first examples in Italy of an integrated system between personal fabrication and cultural heritage. In this scenario, tradition and innovation represent the two fundamental elements of a scientific and cultural project consisting of research, education, innovation, inclusion, and sustainable development (Trunfio and Campana, 2020).

The *National Roman Museum* recently launched a multimedia project, the audio guide "Ruins", already available online during the lockdown due to Covid-19, based on the QR technology. In detail, the aim of the project is to allow visitors to access the contents on a web platform through the QR codes present in correspondence with the works in the museum.

The *National Etruscan Museum of Villa Giulia* was the set of a 360° Virtual Tour made available by the Cultural Association Una Quantum Inc. (www.unaquantum.com). The Virtual Tour was created thanks to workshops held by virtue of the manifestation of interest in cultural initiatives by various categories of stakeholders and was subsequently enriched.

The *Regional Park of Campi Flegrei* launched a collective mapping project named #unparcodistorie with the support of MappiNa - MappiNa - *Alternative Map of The Cities* & *CityOpenSource* - Collaborative *Mapping Platform.* Through the app, people can tell their visiting experience at the park. Anyone can geolocate digital content (photos, videos, audio, and texts) through technologies such as GPS, beacons, and WI-FI and talk about work and research, sport and leisure. The ruins can be narrated through different digital contents (photos, videos, audio and texts) but also by different authors who contribute to the story of that ruin with respect to their knowledge and experience. In addition, anyone who contributes to the map of the Park providing their own map with all the contents they have localized.

The *Colosseum Archaeological Park* recently launched a new official website, developed in collaboration with Mondadori Electa, aim at shape a digital environment with a simple and usable language and interface, able to combine the inexhaustible richness of the Park with an agile narration, clear, and emotionally engaging for the user. The webpage provides the users with the opportunity to live a real virtual tour of the archaeological areas of the Colosseum, the Forum, the Palatine Hill, and all the other masterpieces housed within the Park.

A similar initiative is the one proposed by the *Archaeological Park of the Appia Antica*. It is an app named ItinerAppia and made available to the public to improve their experience in visiting the Archaeological Park of the Appia Antica. Thanks to ItinerAppia, visitors can set up their own visit to the Park by accessing all the necessary information both from the website and from the app. Thanks to the QR codes on each panel it is possible to obtain information on individual monuments or start the itineraries proposed by the management. Each itinerary is accompanied by useful information such as kilometers to travel, travel times, opening hours of the sites, etc. Within the app, an audio guide with over 40 contents is also available.

Another great example of value sharing is represented by an initiative launched by the *Herculaneum archaeological site* and named "Herculaneum 3D SCAN", It is an innovative initiative aiming to share with the community – scientists, professionals and the wider public - part of the very rich documentation on the archaeological site of Herculaneum made possible thanks to the extraordinary contribution of the Packard Humanities Institute.

Provide visitors with the best visiting experience is also the aim of the project launched by the *Archaeological Park of Ostia Antica.* Through an innovation-based platform, the technology of Google Street View, and with the contribution of Unesco, the visitor of Ostia Antica can live the "virtual" experience of walking along the

ancient Roman roads, listening, in the chosen language, to the history and evolution of the site. Therefore, thanks to the Google Cultural Institute, the area can become exportable all over the world.

Similarly, the *Archaeological Park of Paestum* offers its visitors a new way of learning about the history and heritage of the site, thanks to a free app designed with the aim of improving the experience of the Park by following the principles of universal accessibility. In detail, the app is available in 6 languages and also in LIS language and was created by ECCOM in collaboration with VISIVALAB and with the State Institute for the Deaf, and the support of Archeostorie that wrote the texts. In addition, the app offers the opportunity to discover both the monumental elements of Paestum and the aspects of the daily life of the city and of the people who lived there, through a narration made of stories, sounds and scents, and allowing people to interact with the monuments of the park.

In the case of the *Archaeological Park of Pompeii*, new technologies are adopted with a different aim, namely, to safeguard and protect the archaeological site and its visitors. The Smart@POMPEI project was designed by the Archaeological Park together with the CNR (National Research Council), with the aim to improve the security and the safety of the park, thanks to monitors and sensors generating alarms in case of anomalous behavior and in emergency situations. Thanks to the IoT technology, the integrated technological system is modular and flexible, also allowing those new devices, components, or sensors to be added at any time for the optimized and sustainable management of the site.

Finally, with reference to the *Archaeological Park of Sybaris,* no relevant or significant innovation-based initiatives have been detected, although project on the safeguard of the archaeological coastal areas of the Mediterranean basin are being planned.

5 Discussion and implications

Cultural heritage is even more conceived as a resource to improve territorial competitiveness (Alvarez et al., 2010; Garau, 2017; Njovo and Makacha, 2018; Bigné and Decrop, 2019) and, in line with this, optimizing the fruition is a goal for cultural institutions and professionals, looking for new and innovative forms of fruition of the archaeological heritage. Practical evidence shows that national and international institutions are gradually becoming aware of the potentialities of this sector proposing projects and initiatives to exploit and valorise archaeological resources.

In the following table, some representative examples have been summarized, to highlight the most used technologies and the most common purposes of archaeological organizations adopting new technologies and pursuing a digital transformation of services.

Table 2 – The most representative technology-based initiatives carried on by the organizations selected

Museum	City	Initiative and technologies
The National Archaeological Museum of Cagliari	Cagliari	Virtual tours
The National Archaeological Museum of Naples	Napoli	Digitalization of contents for the inclusion of all the categories of visitors
The National Archaeological Museum of Reggio Calabria	Reggio Calabria	Digitalization of contents for the inclusion of all the categories of visitors
The National Archaeological Museum of Taranto	Taranto	New technologies and innovation to design user's-centred activities
The National Roman Museum	Roma	QR technology to allow visitors to visit the museum in remote
ETRU National Etruscan Museum of Villa Giulia	Roma	Virtual tours

Regional Park of Campi Flegrei	Pozzuoli	Co-creation of digital content to improve the visiting experience
Colosseum's Archaeological Park	Roma	Virtual tours and interactive experiences through the official website
The Appia Antica Regional Park	Roma	QR technology to allow visitors to shape their own visiting experience
The Herculaneum archaeological site	Ercolano	Value sharing through new technologies
The Archaeological Park of Ostia Antica	Ostia	Virtual tours
The Archaeological Park of Paestum and Velia	Paestum	Virtual tours to make the site more accessible for each category of visitors
The Archaeological Park of Pompeii	Pompei	New technologies to safeguard and protect the site
The Archaeological Park of Sybaris	Sibari	New technologies to safeguard and protect the coastal archaeological areas (in planning)

Most of the initiatives are based on the use of social and mobile technologies and the implementation of tools as beacons, smart crickets, QR technology, GPS, and Wi-Fi (Charitonos et al., 2012). These tools are mainly used to collect data and provide visitors with information about the site, guiding them in their visiting experience, and allowing them to interact directly with the artworks (Cuomo et al., 2017; Christidou, 2018; Koutsabasis and Vosinakis, 2018), as well as to express their preferences shaping a visit path. Although several initiatives are also focusing on the safeguard and protection of the archaeological site as in the case of Pompei.

Both literature and practical evidence show that, despite the growing interest in the topic, the digital transformation of the archaeological heritage is still scarcely investigated. For hence, it is still hard to detect how and how much new technologies and innovative digital solutions are benefiting the sector. In fact, although the integration among different ways to enjoy cultural heritage is pursued with the aim to Integrated products and services to transform the customer experience, it has still to be fully embraced.

The main aspect to focus on is the engagement of customers as innovative initiatives and new technologies are not enough to transform the customer experience. The solution suggested by scholars is to empower the customer-driven decision with actions leading to the transformation of the offering and, as a consequence, of the customer experiences.

The integration between the physical elements of cultural heritage and virtual space means the combination of the authenticity of the culture with innovative services to create new value opportunities and outcomes via unique experiences. This also allows the re-evaluation of the role of new technologies and confirms that the role of cultural sites as archaeological areas and museum is changing and offers the opportunity to live immersive and educational experience. In addition, practical results highlights that an effective human-technology interaction can enhance heritage preservation and culture diffusion, contributing to the local sustainable development (Trunfio and Campana, 2020).

In conclusion, customer engagement creates new values for both visitors and cultural organizations, as the digitalization of cultural resources provides a global access to art, providing new ways for audiences to visit the cultural site both physically and virtually. As a consequence, this expands cultural presence to wider audiences from different contexts (Palmi and Madaro, 2020).

6 Conclusion

Digital transformation is by now recognized as an effective way to improve the provision and fruition of services (Ciasullo et al., 2016; Cuomo et al., 2021; Li, 2020; Russo-Spena et al., 2021). Indeed, contributions on this theme are growing in number but there is still a lot to do in practice, especially in cultural heritage,

although evidence highlights the potential of the implementation of innovative solutions and digital technologies (Charitonos et al., 2012).

Literature on digital transformation can represent a resource for institutions and practitioners aiming at valorising the archaeological sector, but further theoretical and empirical research is needed to offer concrete insights and effective solutions. In regard, this paper can be framed in the international debate on the digitalization of services and on the digitalization of the cultural heritage contexts and offerings to improve the fruition and enhance visitors' experience. Indeed, as already discussed in the previous section, theoretical advances and practical results show that the digitalization can offer a social value to wider audiences, thanks to the involvement of visitors through the virtual experience. In fact, the creative use of digitalization favors the innovation of the Business Model in cultural organizations, strengthening their social mission (Palmi and Madaro, 2020).

Anyway, cultural innovation is not always immediately realized and embraced, especially as it concerns archaeological sectors. Therefore, further initiatives – also from different contexts - are needed to recognize the real benefits new technologies can bring to the archaeological sector, with special reference to the two main goals currently embraced by cultural organizations, namely the enhancement of the visiting experience and the safeguard and protection of the sites. In conclusion, the study contributes to the academic literature as currently the research on the digital solution for the fruition of the archaeological heritage is still scarce.

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