inTegRated mAnagemeNt modelS For archaEological paRks TRANSFER

INTERREG V-B Adriatic-Ionian ADRION Programme 2014-2020, Priority Axis 2
Project No 1071

WORKING GROUP 3 FINAL REPORT
ICT tools and solutions for the valorisation of Archaeological parks
(Activity T1.4- Deliverable T1.4.1)

27 February 2021

WORKING GROUP 3:
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TABLE OF CONTENTS

1. INTRODUCTION

The research of WG 3 focused on ICT tools and solutions for the valorisation of Archaeological parks. The following partners contributed to the work:

Country	Organisation
IT	University of Macerata (PP)
IT	Università Politecnica delle Marche, Ancona (AP)
IT	Playmarche Srl (PP)
IT	Direzione Regionale Musei Marche (LS)
AL	Institute of Archaeology (PP)
AL	Institute of Cultural monuments (LS)
SI	City of Ptuj (PP)
SI	Scientific Research Centre Biastra Ptuj (LS)
SI	Postgraduate School ZRC SAZU (PP)
SI	Institute for the Protection of Cultural Heritage of Slovenia - OE Maribor (LS)
RS	European Youth Center (PP)
RS	Youth portal - Najstudent (LS)
GR	Ephorate of Antiquities of Ioannina (PP)
GR	Dpt of Informatics &Telecommunications, University of Ioannina (LS)
GR	Computer Technology Institute and Press "Diophantus" (PP)
GR	University of Patras – Dpt Computer Engineering & Informatics (LS)
HR	Municipality of Omišalj (PP)
HR	Association aIPAK (NGO) (AP)
HR	Public institution development Agency of Sibenik-Knin County (PP)
HR	Muzej grada Šibenika (Šibenik City Museum) (AP)
HR	Urbanex (external expert from DA SKC) (EE)

CTI-Diophantus was the WG3 Leader. The working group partners attended four meetings, starting in July 2020 and ending in February 2021. Each meeting resumed the integrated results of the research conducted by the partners and determined the methodology of the next step. All partners made contributions to all stages. More concretely, the methodology adopted was the following:

- For §2.1, WG3 partners were divided in three subgroups, each of which submitted a common contribution.
- For §2.2, one partner took the lead of each subparagraph, coordinating the contributions of the other partners.
- For §2.3, representatives of each one of the case studies (i.e. the six AP) collaborated internally with colleagues from the other WGs, in order to come up with concrete ICT solutions adapted to each scenario.

Moreover, representatives of the other working groups made contributions to the meetings, while the WG leaders and the coordinators of the project held regular meetings in between, helping thus to incorporate the results of all WGs to the final composition. Due to the pandemic, no physical meeting of WG3 took place during this stage. Collaboration and meetings were held virtually, confirming in a way the possibilities of ICT tools!

2. ICT tools and solutions for the valorisation of Archaeological parks

Archaeological parks are not only an integral part of their territories but also the main testimony of interactions between humans and their environment and of interventions transforming the area into a cultural landscape; thus, their preservation and sustainable valorisation are vital cultural, social, environmental and economic assets.

2.1. Analysis and synthetic interpretation of relation and interactions between parks, ICT tools, Cultural Heritage and territories

Considering the broader European framework, i.e.:

✓ Cultural policies, trends and recommendations such as the Faro Convention (2011), recognizing the individual and collective right to access and engage with Cultural Heritage (CH) and fostering democratic participation by the use of digital technology.

✓ EU's perception of CH as a source of sustainable development, improving people's lives and living environments (EU 2014).

✓ European policies encouraging digitization and the use of ICT as valuable horizontal tools at the service of these priorities (Council of the EU 2014).

as well as the generalized digital transformation, i.e.:

✓ The constant evolution and ever-widening dimensions of ICT

✓ Their fruitful adaptation to the field of CH

✓ Their potential to democratise access to culture, also recently highlighted by European Year of Heritage (Sciacchitano 2019; Lykourentzou 2019)

and reckoning with the recent restraints of the COVID-19 pandemic and their consequences in the current scenario(European Heritage Alliance 2020, NEMO 2020)

n order to transform them into opportunities, we conclude that the relation between ICT and CH becomes increasingly strong and complex:

➢ facilitating and expanding access and interpretation,

➢ raising awareness on issues of cultural and environmental protection,

➢ fostering new forms of multilevel and multi-stakeholder participatory governance,

➢ encouraging creative industries, SME and community-led initiative for the development of the territory.

Under this perspective, interactions between archaeological parks and territories could strongly benefit from the digital shift, creating synergies and cross-sectoral cooperation.

2.1.1 Issues related to the understanding and the contextualisation of the archaeological ruins

The first step towards the integration of ICT in archaeological parks is the understanding and the contextualisation of the archaeological ruins.

Main issues are:

✓ Intrinsic to the ruins and to their relation to the territory: location; state of conservation, also of the site in his complexity; accessibility; particularities of the territory; space evolution and transformations of the landscape; relation to present-day area, geolocation, etc.

✓ Methodological: general scientific approach; survey – exploration - excavation techniques; diagnostic, conservation and restoration; study and interpretation, etc: this chain will lead to the understanding of the ruins by experts and then to its valorisation through various methods, means and media.

✓ Managerial: legislative and administration framework; proprietary state; governance; financing; stakeholders; conservation issues; safety concerns; copyright, etc.

To these, we should add issues linked to ICT, such as:

✓ Infrastructure: hardware, software and apps installation, maintenance and update

✓ Cost: particularly high for state-of -the art ICT applications

✓ Attitudinal barriers: many CH professionals are still sceptical about ICT applications, notably about the accuracy of the representations and the "poetic licence" of storytelling scenarios.

✓ Digital literacy of CH professionals: the lack of digital skills reduces the possibilities offered by ICT. On the other hand, emerging specialisations, such as those defined by the Erasmus+ project Mu.SA (www.project-musa.eu) -Digital Strategy Manager, Digital Collections Curator, Digital Interactive Experiences Developer and Online Community Manager- can multiply the benefits.

✓ Lack of a comprehensive vision of digital site management: an integrated tool, keeping an overall record of data (research, storage, conservation, budget, operation, visitors etc), could create a solid digital chain, allowing multiple and cross-disciplinary uses. On the contrary, archaeologists still use traditional pre-computer tools (niccolucci 1999) and the digital approach in this professionals/academics is very slowly spreading

2.1.2 Specific ICT tools for on-site visits

The adaptation of ICT technologies and tools to the needs of archaeological research and documentation (geographical prospection, mapping, laser scanning, photogrammetry, 360° photography, ultra-high resolution images etc) offers at the same time extensive possibilities for the development of specific ICT tools for on-site visits. 3D-scanning, modeling and reconstructions are used in advanced VR imaging technologies, adding layers of understanding and interpretation to the ruins. Mixed Reality (MR) and Augmented Reality (AR), blending the virtual with the real, have found ideal application areas in archaeology and heritage (Roussou 2008, Forte 2016).

These tools offer different approaches and degrees of engagement:

➢ guided or self-guided site tours, with various degrees of personalization, initiative, interaction and diverse points of view (360°-panoramic, bird-eye, underground, magnification of details, overlaying of different archaeological layers…)

➢ virtual compensation of objects, reconstruction of structures and of the environment, 3D-prints, animation, holograms etc, giving the possibility to follow the different phases of a building, development of a site, the evolution of a territory…

➢ storytelling, gaming, treasure-hunting, rpg.

➢ immersion, combining AR, MR and interactive panoramas, and stimulating the sense of presence by addressing more than one senses (sound-scape, haptic technologies, olfactory triggers…).

➢ Analysis and feedback in relation to the quality of visits, that was demonstrated as mandatory for reaching expectations of users (Pescarin 2014) and recently should be obtained via automatic or more efficient systems (Quattrini 2020).
These tools are accessible either via personal devices (smartphones and tablets) according to the definition Bring Your Own Device (BYOD), or via devices offered by / integrated in the site.
Personal devices are the most effective way of enhancing visitors' experience, without expensive infrastructures. The easily accessible apps don't require downloading of heavy data packages -but they need a stable internet connection. In particular the so-called web-apps strictly present this requirement. They foster personalized, tailor-made experiences and allow visitors to share their impressions through social media. Moreover, they are safer to use from the point of view of sanitary measures.
On-site equipment, such as monitors, projectors, touch-screens, interactive floors, VR headsets, sound-systems, audioguides etc, is more expensive, requires infrastructure, maintenance, and presents special difficulties of installation in open-air sites; on the other hand, it can create spaces and ambiences fostering a unique immersive experience.
Some of the benefits of this approach:

✓ Improved access (both intellectual and physical), overcoming barriers such as language, age or disabilities

✓ Audience attraction, diversification and development

✓ Approach on a visual, auditory and textual basis

✓ Knowledge processes with the "sensory-motor" method instead of the "symbolic-reconstructive" one

✓ Enhancement of visitors' experience

✓ Edu-tainment, combining educational approach to entertainment

✓ Motivation for repeated visits

✓ Fostering of multi-disciplinary collaborations

✓ Enlargement of the attractive potential of the territory

Nevertheless, the main challenge of these tools is to enhance and integrate the "real" experience of the site without overshadowing it or distracting the visitor.

2.1.3 Specific ICT tools for remote communications

Tools developed for remote communications can have multiple uses:

➢ Pre-visit: helping visitors prepare and organize their experience

➢ Post-visit: consolidating the experience

➢ Substitute to a real visit (nowadays more than ever, because of the pandemic), with special features breaking down barriers and expanding access to the site to all categories of virtual or potential visitors. Particular stress should be given to the possibilities offered to people with disabilities.

➢ Gaming, social networking and other tools creating "long-lasting" links with users.
Typologies of data acquisition that are more adequate for the development of remote-visit projects are: 3D modelling from SfM photogrammetry integrated also with laser scanner; 360° photography combined with interactive panoramas (the most popular example being Google Street View Technology and Google Arts &

Culture program, providing the opportunity to use street view but inside the museum / site); or even 360° videos, the next level of the 360° experience, where a view in every direction is recorded at the same time, shot using an omnidirectional camera or a collection of cameras. YouTube provides online 360° videos from 2015; interactive maps; etc.
Moreover, the same tools used on-site can be adapted for remote communications, either at home, using personal devices and accessed via internet, or in dedicated spaces connected to the site (at the entrance, eventually combined with an information centre and/or a souvenir shop, nearby or even far away).
An interesting option of remote communications (online chat, live video, social networks…) is the possibility to follow in real time activities taking place in the site (a guided tour, field work, restoration, various cultural activities…)
Social media and other real-time apps allow actual visitors to connect to potential / virtual visitors and share their experience. This is a crucial aspect of ICT when addressing native digital generations, like Generation Z, who are not passive users but content-producers, eager to interact and to exchange.

2.1.4 Other tools

The edu-tainment approach can actually transform archaeological parks into stages that mediate the relationship between the contemporary visitor and archaeology, new media and technology:

➢ **video and projection mapping techniques,** projecting lights and images on existing surfaces, are the result of cross-sectoral collaborations, involving researchers, ICT professionals, artists, directors, light designers etc. The combination of images, lights and sounds can give birth to sensory journeys.

➢ **AR/ MR/ VR apps**, proposing various "scenarios" of visits, involve directors, scenarists, actors… and "props" and allow visitors to select among different levels of interaction and immersion: spectator, treasure-hunter, role-player

➢ The use of "**personas**" encourages the audience to engage and explore actively the site and the territory, co-creating a personalized experience through a wider freedom of choice of activities, times and typology of learning, stimulating problem-solving skills as well as system thinking and willingness to cooperate.

➢ **Image recognition/AI** can be used in applications providing a gamification experience.

➢ **Holograms**

➢ **3D-modeling** and **3D-printing** with free access to open data from the collections of the site can foster contemporary artistic creation and support creative industries.

➢ **user-generated content** and the growth of social media stimulate interaction and creativity.

2.1.5 Conclusions

One of the most important benefits of ICT is that they can connect the site to the wider territory, in the context of a networking strategy that can help integrate other "tourist attractions" into a comprehensive valorization circuit, proposing various itineraries and promoting different aspects of the area through a holistic "pack" of experiences.

A main aspect to be taken into consideration is the possibility of ICT to provide feedback, assessment and evaluation of various aspects of the AP management and operation.

2.2 Analysis of the reference scenarios.

Moving on from the theoretical framework of ICT on the service of archaeological parks and territories to the practical analysis of the reference scenarios, i.e. the selected case studies, it becomes obvious that the current state of digitalisation process reflects directly the priorities, orientations and choices at national, regional and local level, as well as the strenghts, weaknesses, opportunities and threats stemming up from the general management scheme of each park.

2.2.1 Current state of digitalization

The reference scenarios correspond to three main levels of digitalisation, with various degrees in between:

1. Level 1: no infrastructure / internet connection; no digitalisation; no ICT tools. It's the case of **Antigonea** or of **Poetovio.** So, the perspectives offered by the TRANSFER-model are very interesting.
2. Level 2: Digitalisation mainly for purposes of documentation.
   In **Mirina,** recently excavated archaeological material is **documented digitally**; detailed plans in computer design and photogrammetry could be used in future applications; one important monument has already been **3D reconstructed**. However, a huge amount of earlier material hasn't been digitalized yet and the lack of specialized staff doesn't help in this direction. **Šibenik City Museum** uses an obsolete system of digitalization of its collections for purposes of documentation and lacks **proper equipment for the process**. Future projects include a **national digitalization program,** which hasn't been implemented yet.
3. Level 3: Digitalisation on the service of the management. Leveraging ICT tools to enhance the accessibility, communication and promotion of the site.
   The archaeological site of **Dodona** has **a wireless internet network.** Moreover, a **3d representation** of the site in the 3rd c. B.C. and a **3D video with the successive phases** of the sanctuary have already been prepared. Future projects include **3D reconstructions** of the main buildings and the development of an innovative **platform for creating tour applications** using elements of augmented reality and gaming.
   In **Urbisaglia,** an interactive 3D modelling and visualisation of the roman territory and the city of *Urbs Salvia* with **VTERRAIN** proposes not only new and innovative methods of organising the data themselves but also new perspectives for visitor / tourist use; **QR-codes** are placed in the archaeological area; **3D-printing models** enhance accessibility for visual impaired; **videos** uploaded on the web allow remote communication. Furthermore, Urbisaglia has recently been involved in important projects, aiming to develop **versatile 3D models** and multimedia contents, that can be used in further AR and MR applications.

Yet, despite the disparities between the case studies, some common observations emerge from a basic SWOT analysis:

Strength	Weakness
The intrinsic value, and in many cases the visibility /recognizability of the site / the territory.	The lack of a comprehensive digital policy and of an integrated tool for the management of the site.
Opportunity	**Threat**
The project TRANSFER: a management model including ICT tools with multiplying effects for both the site and the territory.	The lack of continuity in projects, policies and strategies.

2.2.2 The relationship between parks and surrounding landscape in relation to the ICT tools

The given "passive" relationship between parks and surrounding landscape has infinite possibilities of evolving into an inter-active exchange.

The analysis of the reference scenarios highlights not only different levels of interaction, but also different perceptions of the very nature of this relationship, hence defining the most useful ICT tools in this direction.

- ICT as a **facilitator**: landscape is an integral part of archaeological sites, essential for their perception. Better understanding of the geographical position and of the relationship Site/Territory in its historical dimension adds useful layers of perception. Antigonea, for instance, held a strategic position in the Drino valley, in relation to other satellite sites, fortifications and roads, which can be grasped better through the use of ICT tools.

  New technologies foster new interpretations and help bringing users closer to archaeological heritage, by re-crating the space / time evolution and transformations of the site's landscape; thus, the *cultural landscape* dimension is valorized, putting forward the relation of CH to present-day area. This offers new opportunities for cultural heritage education through *edutainment*. The archaeological site of Dodona, for example, could offer its numerous visitors an enhanced experience, developing further the already-existing 3D-reconstructions adding the layer of landscape in AR and VR applications etc.

  Moreover, ICT encourage a more inclusive and "democratic" perception of CH, breaking down barriers of accessibility (physical impairments, cognitive and socio-economic obstacles etc). Of particular interest is the comparison between the physical, emotional and cognitive experience of the actual archaeological park and the experience of that same park created and reconstructed through ICT, or of the "real" space and the intervention of tools such as light design and 3D-video mapping.
- ICT as a **mediator** between the archaeological site, the surrounding territory and the (potential) users. The web offers loads of disparate information, which can be filtered and channeled to foster this relation. New technologies (i.e. geo-localization) allow traceability, visibility and accessibility of a larger area; moreover, they can help connecting the archaeological sites with the territory and structuring a liaison between the scattered cultural heritage: this is the case of Urbisaglia and the PlayMarche DCE project, focusing on the development of a Game-App dedicated to the discovery of some of the towns of Macerata Province. The network of sites around Šibenik could largely profit from a joint presentation.

- Yet, the breakthrough revolution is the transition to a human-centered / user-centered approach, facilitated by the use of mobile apps, personal devices and location-aware tools: *Marcheology* (https://www.marcheology.it/en/), the geoportal for Marche archaeological heritage developed by Polo Museale Marche, offers users the possibility of organizing all aspects of their experience, including not only local attractions and special events, but also offers of food, accommodation, buys etc. This could be a useful example for the city of Ptuj, which is establishing an ICT network in which the AP Panorama could be included in a unified plan, promoting the larger cultural heritage region – complex as a tourist destination (and resolving, at the same time, maintenance issues). The perspective of joint initiatives between countries (such as a common website promoting neighbouring archaeological parks of Albania and Greece) would also increase their international reverberation.
  It is important to observe how the complementarity between the territorial dimension and the cultural dimension increasingly passes through new technologies, although ICT tools cannot be considered as a substitute for heritage or territory: their role is to create multiple links between the two dimensions.
- ICT as an **awareness-raising** tool: New technologies on the service of landscape education and cultural heritage education can foster the understanding of complex notions, thus developing a greater civic sense and an active engagement in the sense of responsibility. Environmental issues, such as those faced by Mirine-Fulfinum, surrounded by industrial facilities with possible invasive effects
  ICT can offer useful tools for empowering local communities; moreover, it has the potential of connecting people, not only at regional, but also at national and international level.

2.2.3 For an integration between the site enhancement processes and the territorial infrastructures

The contemporary urban landscape is the evolving image of dynamic social, economic and ecological changes and heterogeneity. It constitutes the mirror of history, natural and cultural, urban processes. The presence of an archaeological park deeply influences the dynamics of territorial development. In this framework the development of systems for the knowledge of the territory can become a fundamental urban planning tool for public administrations use in the various stages of development policy programming regarding the territorial infrastructures.
The integration between the site-enhancement processes and the territorial infrastructures has to consider the observations from both the current situation of each case and the existing relationships and trends between the site and its territory. The first step would be a PEST analysis facilitating the understanding of the current situation, the expectations and the trends at various levels and thus pointing out the needs and possibilities of ICT tools, both in the management and in the enhancement of the parks in relation to their territories.

Political The informed participation of all the important actors (central and regional administration, Archaeological Service and local stakeholders) it is of major importance to build a comprehensive collaboration and reach a consensus	**Environmental** The existence of protected and green areas, as well as the proximity of the site to large urban centers, have to be considered.
Socio-economical Defining the stakeholders and networking in a broader perspective of common interests and benefits, bringing together academic and territorial institutions as well as local enterprises, working in the Park with its cultural heritage and the understanding of its potentials.	**Technological** Mapping of existing infrastructure and ICT resources from all stakeholders and the exploration of bridging and collaborations having a direct impact on visibility and on the integration in a wider national and international framework.

Next comes the development of an integrated and sustainable governance model, made possible by a series of tools made available in an integrated and implementable form (including ICT). Thus, in the immediate vicinity of an archaeological park, an area subject to specific use and enhancement regulations, including environmental ones, planning will take place on the basis of shared parameters both in terms of territorial planning and governance. Moreover, infrastructural works would be better planned in a shared-governance framework.
Then, the enhancement process would start with the implementation of relevant digitalization methodologies and ICT tools.
Finally, joint projects should be planned and implemented, starting from infrastructure and evolving towards more ambitious ICT tools fostering fruitful collaborations within the territory. Eventually, focusing on tools such as *Marcheology* can be the starting point for a fruitful collaboration with local activities and enterprises that can positively affect the local economic growth both directly and as a secondary repercussion.

2.2.4 Users' interest tracking system, users' profiling, decision-making tools related to fruition analysis and management

Decision-making tools should be developed within the spirit of the World Heritage Convention, in order to '*encourage everyone to participate in the process of identification, study, interpretation, protection, conservation and presentation of the cultural heritage*' (Article 12a of the Faro Convention).
First, it is appropriate to consider the usefulness of tracking the interests of users and their profiling not only in the final stages but also during the methodological approach and the operational activity of collecting research data. Both phases are indeed crucial as they offer the opportunity of comparing different skills, approaches and expectations (coming from researchers, directors, curators, but also administrations, companies and managers) regarding the importance of knowing better the users.

The definition of “public” itself is very complex (which and how many categories fits in it?) as well as the frame of an archaeological park, which is to be considered as an “archaeological landscape” where users not only benefit from the cultural heritage but also of other kinds of services (educational workshops, bookshops, coffee shops etc.).
Approaching the “public” we also need to distinguish:

- real public: people who not only go to the park but also participate in its activities. For these users, forms of membership and fidelity programs can be thought;
- potential public: those who could be interested in the park but have not established a relation with it yet. Expansion strategies should be directed to this group;
- non-public: those are the users who do not consider the park capable of meeting the expectations associated with their free time.

Moreover, not all the information obtainable from user tracking and profiling are useful. Thus, it is necessary to focus only on those relevant for operational activities. What we really want to get information about is:

- user's socio-demographic profile (age, gender, origin, educational qualification, etc.);
- motivation (i.e.: cultural, tourism, socialization or relaxation): useful to evaluate the effectiveness of marketing and communication;
- experience: its evaluation is needed to improve the weaknesses and emphasize the most appreciated aspects;
- ICT and other communication strategies: the analysis of their use and effectiveness is essential in evaluating what is already in place and what needs to be implemented;
- cognitive learning process: it is crucial to understand whether the visit has contributed to increasing knowledge or interest;
- behaviour during the visit: useful for evaluating the effectiveness of the path and the communication apparatus such as captions and panels.

About the Parks

In **Antigonea** should be undertaken a new management plan as applied in other parks in Albania such as Butrint and Apollonia. Also, a better coordination between different institutions such as the Institute of Archaeology, the Institute of Monuments the DRTK Gjirokaster, local government should be undertaken. As Antigonea is situated in the ancient Epirus, in vicinity to the Greek border a promotion in a joint website of Greek and Albanian sites will be very helpful in the advertising of the area.

Concerning **Dodona**, it has to be noticed that, in Greece, the decision-making tools related to fruition analysis and management of an archaeological site requires a dynamic opening of the Ministry of Culture and Sports towards the proposed stakeholders, according to the specific characteristics, needs and environment of the archaeological site. This taken into account, a good strategy of implementing the effectiveness of user’s tracking systems in the management and planning activities could be the one of integrating all the sources that allow us to get info about user’s interests and needs with the work of various committees and working groups, workshops and individual meetings with local stakeholders.

The site of **Mirine-Fulfinum** needs yet to be enhanced, and the ICT tools should be installed. Therefore, there is no organized tracking system in use, for now. However, few internet sites publish and inform us about the park. These are the only ones that can be used for the analysis of both interest and users' profiling, but they should be targeted.

The remote sites connected to **Šibenik** need infrastructure for monitoring installations, also useful for tracking visitors behaviour in a passive way.

Ptuj is already a recognizable tourist destination, with well-developed tourist offer in town. The possibility to expand and upgrade the offer, including AP Panorama, should take into consideration the users profiles, needs and expectations in an active way.

The Archaeological Park of **Urbisaglia** is advertised in some sites and apps and has its own page on the Municipal website. All these systems can be a starting point for a user's tracking strategy, but they need to be implemented and targeted in order to be useful. A more effective enhancing plan should include social media strategies as well as a better visibility in institutional websites, local manifestations and activities and dedicated touristic tools, websites and advertised activities. Also, the role of Meridiana srl, which works on the park and manages its touristic activities, should be considered.

2.2.5 Conclusions

What has been so far discussed makes quite clear that the first step approaching users' interest profiling should be the design of a digital communication space: website, mobile apps, newsletter and social media. Also, membership campaigns or the adoption of cards dedicated to customer loyalty should be useful.

There are different types of profiling on the web and here it is important to examine also more respectful approaches to our visitors.
For instance, Cookies contain data that allow users to be monitored and profiled while browsing, to study their movements and habits of web consultation or consumption as well as for the purpose of sending advertising for targeted and personalized services (so-called Behavioural Advertising through profiling cookies). Given their privacy invasiveness, the legislation requires a proper information of the user and the request of their consent (the refusal of consent only affects the ability to access some functions or contents and not the site as a whole).
Profiling and segmentation activities allow us to devise ad hoc strategies and navigation paths, also by synchronizing the personal 'identity card' with the digital ecosystem. The interaction and preference data enable us to create a mapping of interests and activities, remotely and in situ (ticket purchases, participation in webinars, online purchases ...). By the synchronization of personal, behavioural and historical data, it is possible to draw up a user profile, segment it and approach all useful marketing and communication strategies.
Profiling data can be collected through 'registration' on the site itself. Four main types of approach to accessing the site can be identified:

- mandatory registration: it achieves a more complete profiling, but its filling may annoy the user;
- optional registration;
- silent recording: it is a mandatory registration, but it only concerns some sections and activities of the site;

- no registration: data may be requested at every access.

Social networks are other valuable tools for communication and profiling: a more immediate link is established with the followers, depending on a more inclusive type of interaction. It is possible to store a huge amount of structured data as these tools have sophisticated algorithms by which they correlate user activities, reconstruct social networks, keep track of the clicks made and the time spent on a specific content and automatically analyse the messages transmitted by users.

Other than online tools, in situ tracking systems can analyse the silhouettes of people passing by, detect the number, even without any storage or management of images, with privacy compliance. It could also be connected to the site with a check-in web service to produce statistics. Advanced tracking technologies based on video streams and analysis of user and visitor behaviour, conceived with an interdisciplinary approach and combining museological and museographic knowledge and expertise in Artificial Intelligence, should be considered for a next generation of users' profiling. A useful example on this account can be *Visitracker*, the system developed by the Department of Education of the University of Oslo in collaboration with the National Museum of Oslo, which conduct surveys in the form of questionnaires, and track and analyse real time observations of individuals and groups in Museums.

It is also possible to design of new forms of data visualization (e.g. Management Dashboard) and KPIs (Key Performance Indicators) for the determination of uses and bringing to a decision support tool for the manager, stakeholders and/or decision makers in archaeological park.

To conclude, all these operations are relevant not only in the project phase (to test the efficiency, the usability, to drive design and decisions) but also during the everyday management and life of the park in order to have feedbacks about the communication effectiveness. These data are essential to improve not only the user experience, but also the purpose and enhancement of the archaeological park as a whole. This paradigm is surely enhanced if the digitization process is implemented in all phases of planning and managing the archaeological park. this is crucial to measure the impacts of DCH experiences in relation to specific targets and calibrate subsequent actions, including the construction and design of a 'digitization chain'.

2.3. Ideas and projects for a Common Sustainable Governance Model

ICT offer a wide array of tools, whose main interest is their versatility, thus their possibility both to serve a Common Sustainable Governance Model and to be adapted to the specific needs, expectations and limitations of different case studies.
ICT tools offer various solutions to the:

1. Organization and management of the Archaeological Park
2. Research and maintenance
3. Information and Interpretation resources
4. Connection to the territory and its resources
5. Quantitative and qualitative monitoring of the AP

Many of them are useful in more than one sectors, contributing to the holistic governance of the AP.

2.3.1 Organisation of the Park Plan

In order to support the general organization of the Park Plan, the first step is the implementation of the main infrastructure: hardware and software.

- **Personal Computer/ Workstation**: the most basic ICT tool, storing, processing and retrieving data.
- **PC's peripheral devices**: printers, scanners, projectors, interactive whiteboards.
- **Local network:** assists a collaborative scientific and administrative work
- **Internet access**: allows connectivity and the fastest flow of information.
- **Software**: various programmes assisting the general organization and the management of the Park
    - Project manager
    - Communication platforms
    - Web applications
    - Cloud services)
    - GIS system: very useful in all phases of development, implementation and updating of the Management Plan. It offers a quick overview of the area, its environmental and administrative / legislative norms and constraints. If accessible from all the actors involved in the Park's management, a GIS system eases the collaboration between them as well as the effectiveness of their actions; Furthermore, an integrated database recording all the archaeological finds should provide a full resource for the evaluation and planning of the conservation work and maintenance of the park, its environment, its structures and artefacts. A GIS system also provides tools for utilizing GIS data.
    - "Integrated Archaeological Site Management Information System" (a kind of Digital observatory): a platform gathering and offering daily a holistic account of the Park's operation (e.g. opening hours, timetable of public transportation…). Moreover, if connected to CCTV, it enhances monitoring of the Park.

- **CCTV, drones, live webcam**, ***in situ*** **(contact or contactless) sensors, IoT technologies:** linked to a central information system, they monitor in real time the status of the Park and its structures. Moreover, they can monitor access and human activity in the park, assisting the surveillance and helping with the planning and implementation of preservation strategies as they allow to calculate the anthropic impact on the cultural heritage.

2.3.2 Research, documentation, maintenance and protection

- **Digital cataloguing** of the archaeological findings (including all earlier phases of the research) and of all the metadata linked to the research, study, maintenance of the AP, is the most important initiative in this category. Many software solutions are available. More specific:
    - 1) Collective Access is a free, open source cataloging tool and web-based application for museums, archives and digital collections. Its main focus/strength is on cataloging and metadata
        - -Accessible anywhere via web browser
        - -Pre-configured with popular metadata standards
        - -Customizable fields, views, workflows, and more
        - -Quickly creates PDFs and spreadsheet reports
        - -Supports batch importing, exporting, and cataloguing
        - -Easily style to fit your brand's look and feell
        - -Browse with customizable facets and filters
        - -Switch on/off public commenting, tagging, and rating
        - -Display content via maps, timelines, and visualizations
        - -Multiple options for media display and interaction
    - 2) CollectionSpace is web-based, open-source collections management software for museums and more.
        - -Professionally manage your organization's collections with user-friendly, web-based, open source software
        - -Improve stewardship of the resources you hold in the public trust
        - -Support diverse collections in an effective, efficient, and scalable way
        - Share data via web services and an advanced native API
        - -Connect and integrate with tools such as digital asset management systems, digital preservation systems, and content management systems
        - Shorten response time for research requests
        - - Future-proof your organization's technology infrastructure and sustainability
        - -Robust tools to store and describe a wide variety of digital assets, including images, documents, audio, and video files

- **(Aero) photography**: conventional method of documenting environment, archaeological sites, artefacts… In many cases extremely underestimated method is by today's standards relatively cheap and very effective. By photography the heritage can be researched, documented, monitored and protected. Aerophotography gives us data about landscape, settlements and it's excellent method for monitoring the development of regions (urbanization, land-use, natural influences of natural phenomena…) and its impact on heritage. Periodical photography can draw attention to any endangerment of heritage (destruction, degradation…) so its use as a monitoring tool is also justified.
- **Photogrammetry** : a camera collects colour information about surfaces within its field of view. Photogrammetry is technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring and interpreting photographic images and patterns. Digital image capturing and photogrammetric processing includes several well-defined stages, which allow the generation of 2D or 3D digital models of the object as an end product. Comparing to 3D scanning in photogrammetry there can be more "dark areas" which should be processed by software such as MeshLab. Also geolocation isn't priority but with additional processing it can be done with excellent accuracy.
- **3D scanning** – if the photogrammetry is based on colour information, 3D scanning is based on coordinate information. 3D scanning is the process of analysing a real-world object or environment to collect data on its shape and possibly its appearance. A 3D scanner can be based on many different technologies, each with its own limitations, advantages and costs. A 3D scanner collects distance information about surfaces within its field of view. The model produced by a 3D scanner captures the distance to a surface at each point in the model. This results to a point cloud with coordinate and colour data. By 3D scanning the heritage (i.e. the AP within the territory, the structures and the artefacts) can be researched, documented, monitored and protected.
- An extensive database with **GIS system** can integrate the information produced by 3D scanning. GIS data is used as a basis for planning reconstructions, conservations and maintenance work. It serves also as a database for any digital or analogue products for the AP (reconstructions, replicas…). Open Access to the existing documentation has an obvious advantage of data sharing with the research community.

  One of the most popular scanning technologies in archaeology in the last 10 years is LiDAR (light detection and ranging). Research of archaeology has moved from "site research" to "landscape research" and LiDAR technology[1] is

[1] Slovenia is scanned with LiDAR technology and the data is available free online.

suitable for scanning large areas. Its added value is that gives us also information about invisible archaeological remains underground.

- **Geophysics** in archaeology[2] gives data about underground remains. As there are many limitations to the technology (bad ground conditions, no chronological / stratigraphic data, unreliable interpretation, this method needs to be combined with at least one more method (i.e. scanning or photography).
- **Digital replica** of the AP: it maps and records the main elements, including different characteristics (geometrical, mechanical, physical, stylistic, chromatic, etc), in digital formats, using different formats, mainly graphic, such as images, 3d models etc. To achieve this purpose one of the most relevant element is the creation and the use of a unique and integrated workflow, including:
    - data captured through laser scanners, drones, photogrammetry, panoramic photography
    - the elaborations of the 3d and 2d data, such as panoramic images, photos, point cloud and mesh model.

  This system offers the possibility to transfer data of similar workflows into institutional databases, with possibility to feed also Europeana, as well as to manage data in innovative research infrastructure and platform (Ariadne+, 3DHOP etc.).

2.3.3 Enhancement of the information and interpretation of the AP

ICT tools offer numerous possibilities of enhancement and personalization of the experience of the visit. In order to develop fully their potential, it is recommended to ensure Wi-Fi coverage of the AP. Moreover, at least some of the supports or devices (tablets, audio-guides, headsets…) should be provided by the park itself.
Having taken this into account, we can distinguish different levels of immersion offered by ICT:

***High immersivity*:**

VR headsets

Advantages: Maximum involvement of the users, they can have the most realistic and emotional experience about virtual archaeological reconstructions.

Disadvantages: High cost of development; short "technological life"; cost of headsets; necessity of the presence of an operator specialized to help the users; only one user can use the devices; medium maintenance costs; hygienic issues; visitors might hesitate to use it or feel dizzy after using it.

Architectural projections / Light design

Advantages: Adds virtual layer of information directly on the real environment, either by projection using video-projectors or through

[2] Geophysics gave excellent data in the case of Panorama.

holography; users can visit simultaneously and interact with a digital world without the use of specific devices, such as headsets, smartphone or tablet.
Disadvantages: Very high cost of development, installations and equipment; short "technological life"; specific light conditions to work; medium complexity of maintenance.

***Medium immersivity*:**

AR/MR apps

Advantages: Combination of the real world and digital content, projecting directly digital data on the archaeological remains and recalling elements of the surroundings; they can be built on personal devices (Bring Your Own Device – BYOD) or on others owned and maintained by the park.
Disadvantages: High cost of development; short "technological life"; not all personal devices are always compatible; the app might be heavy or require an internet connection; complex maintenance, especially for iOS app; need for precise light conditions to work efficiently; (older) visitors might not feel at ease with their use. For devices owned by the park: need for a charging system.

Low immersivity:

Podcasts and Apps for smart devices

Advantages: Applicable to all devices; free download; simple to use; possibility to personalize the experience.
Disadvantages: Cost of development; short "technological life"; small display; connection speed - need for WiFi; (older) visitors might not feel comfortable to use it.

QR codes

Advantages: Depth and layering of information; easy to develop; low cost.
Disadvantages: Connectivity; some visitors don't use QR code scanner or digital devices at all; visually unpleasant.

Video on screens

Advantages: Low cost of the devices; possibility to involve more users simultaneously; easy to use by the majority; it is easier describe the whole archaeological site according to its contest and landscape.
Disadvantages: Low involvement of the users, consolidated technologies with low interest for users.

Website

Advantages: Wide use; accessibility, remote communication; easy renewal of information, low cost for the AP; communication, promotion and management network of common touristic and cultural projects and offers possibility to develop networks within the territory and its resources or between countries.
Disadvantages: Low involvement of users; needs dedicated administrators.

Social media

Advantages: Very popular amongst many categories of visitors (especially young ones); easy renewal of information, low cost for the AP; possibility to

share information and experience, attracting wider audiences and building a community.
Disadvantages: Needs dedicated administrators; not all visitors are familiar with social media.

2.3.4 Promotion policies and offer of services *via* ICT tools

All promotion policies and offers of the AP and its territory can be served by the ICT tools in use by the Park:
The promotion of the site can benefit also from special events that are centred on ICTs such as the use of light design, augmented reality and 3D video mapping aiming to create a sensorial experience.
QR codes can easily integrate offers and promotional activities.
Apps and games can promote the archaeological park by speaking to a wider audience. the youngest, with contemporary and very captivating languages.
Social networks and websites allow the parc to enter a global market with small investments and to widen its audience.

2.3.5 Resources of the territory to be taken into consideration

In order to plan a conscious and effective use of ICTs it is primarily important to involve the project's partners and stakeholders of the territory: local and regional authorities, civil society, local entrepreneurship and creative industries, education… Strategic planning and cooperation, development of networks at local, regional, national and international level are of prime importance.
Planning the use of ICTs to enhance an archaeological park must also consider the characteristics of the landscape and the natural environment.
Moreover, lots of factors have to be taken into consideration during planning:

- Comprehensive offer of cultural heritage
- Other tourist attractions, local products...
- General infrastructure (utility connections)
- Traffic connections
- Accommodation and restaurants
- Broadband internet (with wireless option)

2.3.6 Quantitative and qualitative monitoring

In order to verify the effective improvement of the park the monitoring of users' feedback and interest is essential. Some of the most common tools used for quantitative and qualitative monitoring are:
Visitor survey – used for quantitative and qualitative monitoring. Depends on the contents of the document we can get reliable information (profiling of visitors). Digital survey is possible but there must be efficient system to motivate visitors to fill it in.

Counters – counters are used often on transition AP areas. Positive side is that every visitor is counted but there cannot be control over double counts and it gives us no information about profiling.
Application profiling – used for quantitative and qualitative monitoring. Depends on the contents of the document we can get reliable information (profiling of visitors). This method requires access to internet and communication device. Even if it is available in AP there is significant part of visitors that are not using it (do not know how or do not want to).
Google analytics – method for counting visitors on the basis of Google account users. This method is based on the fact that many visitors have a smart phone with internet connection and Google account with tracking settings. So it works on the principle of Google Traffic map. Method is limited to a very specific type of visitors.
Smart devices and Apps – allowing to study users analytics, to track visitors path and behaviour; some include digital tools for expressing opinions (e.g. discussion forums) and material exchange, digital writing tools for using personal stories and narrative information to give in the experience of visiting a personal and emotional touch, tour and navigation support applications using mobile devices.
In situ advanced tracking technologies based on video streams and analysis of user and visitor behaviour should be taken into account for a next generation of users' profiling.

Some examples of applications are the following:

- https://www.ratenow.cx/Industry/1/customer-experience/14/museum
  RateNow gives voice to all your visitors in real time so you can identify areas for improvement instantly and transform their cultural experience.
- https://www.nubart.eu
- https://www.nubart.eu/audio-guides.html#visitors-data
- https://www.nubart.eu/audio-guides.html#visitors-feedback

3. General conclusion

Taking into account the work of WG1 it is clear that the use of ICT tools can be crucial in the management and the organisation of the plan for the archaeological park. New technologies allow us to optimise working time and to enhance the preservation of the cultural heritage ad well as its safety and, eventually, to manage and share information and data in a more efficient and safe way (on this account it could be useful to remind the importance of GDPR for the general regulation for data protection).

In relation to the work of WG2, we can highlight the importance of ICT tools for the quantitative and qualitative monitoring *ex ante* and *ex post* of the activities promoted by the park. The use of new technologies, if well planned, can also save some resources on the long run. Eventually, it is important to underline that the implementation of ICT tools in the park can lead to the creation of new jobs and to foster the development of creative industries.

In both cases, it is essential to ensure the training and LLL of the AP's staff, so that they can take the maximum profit of the ICT.

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