Leveraging Underwater Cultural Heritage (UCH) Potential for Smart and Sustainable Development in Mediterranean Islands

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Abstract. Martial incidents during wars (World War I and II), but also shipping fatalities through centuries along the densely populated commercial routes of the Mediterranean Sea have resulted in significant submerged remnants, falling into the Underwater Cultural Heritage (UCH) corps. A large part of this heritage is located in the neighborhood of insular territories. Preservation and sustainable exploitation of this UCH in the Mediterranean presents an important opportunity for both keeping alive the European identity for future generations, and tracking alternative, heritage-led future development trails for remote peripheral and lagging-behind island communities. The paper explores the context of UCH in the Mediterranean and elaborates on the value attached to Information and Communication Technologies (ICT) for reaping this opportunity by means of surveying, geolocating, preserving, sustainably exploiting and marketing this heritage. Based on this exploration, but also on the authors' experience from a specific (U)CH-related cultural planning endeavor, conducted in Leros Island Greece, ICT and non-ICT related barriers for planning heritage-led future trails of insular regions are delineated.

Keywords: (Underwater) Cultural Heritage · Insular territories · Mediterranean Region · Cultural governance · Sustainable development · Cultural/battlefield tourism

1 Introduction

Cultural Heritage (CH) in the 21st century is grasped as a valuable resource and a quadruple bottom line for coping with environmental, social and economic as well as climate change challenges [1]. The realization of the exceptional role and value of CH and its importance in the way to sustainability has guided efforts of contemporary societies towards the: preservation of tangible and intangible cultural resources as a means for keeping track with historical evidence and roots of the past; and their exploitation in a sustainable, resilient as well as value - and human-centric way for reaching qualitative and heritage-led enduring developmental trails of the future. These efforts go hand in hand with policy orientation and a range of related documents, addressing *multiple objectives of glocal (global-local) nature*. Among these objectives

© Springer Nature Switzerland AG 2020
O. Gervasi et al. (Eds.): ICCSA 2020, LNCS 12255, pp. 237–252, 2020.
https://doi.org/10.1007/978-3-030-58820-5_19

fall the preservation and protection of CH as well as its promotion for peace and intercultural dialogue building within and beyond national borders [2], but also objectives such as heritage-led local development and sustainable cultural tourism, social cohesion and sense of belonging, quality of life and attractiveness of cities and regions, to name a few [3].

Sustainable exploitation of CH has, among others, given rise to the *experience-based cultural tourism paradigm* [4]. This constitutes nowadays a quite noticeable and dynamic trend in the evolving tourism market (the supply side) in response to demand-driven signs for new, meaningful and authentic tourist experiences, roughly presented as a combination of four *'e'* words, namely *e*ntertainment, *e*xcitement, *e*ducation and *e*xperience of tourists [4]. Cultural tourism constitutes currently a major segment in many destinations (counts for over 39% of cultural tourism arrivals in 2014), as pointed out by UNWTO [5] and an essential feature of tourist destinations' profiles [6]; while also a factor of decisive influence in travelers' destination preferences.

A particular type of *cultural tourism form*, recently receiving much attention in terms of both attractiveness to visitors all around the world and concerns as to the CH preservation and sustainable exploitation, refers to the *battlefield tourism*, i.e. tourism linked to places in which historical martial events have occurred. *Battlefield tourism* is considered as a variant of *"Dark Tourism"*; and implies tourist activities strongly linked to death and/or war disaster-related sites [7]. Destinations falling into the *"Dark"* category are nowadays proliferating in the global tourist realm; and are also varying in content, taking forms such as battlefield scenes, concentration camps, sites of major human disasters, to name a few.

In the rapidly evolving tourism market, an outstanding and steadily growing tourism niche is *maritime battlefield tourism* [3], i.e. visiting and exploration of *sea-related battlefield scenes*. Properly and respectfully addressing this type of tourism in a specific destination presents a new challenge for planners and decision makers with regard to the protection and preservation as well as the value-based and sustainable exploitation of related *Underwater Cultural Heritage* (UCH) for cultural, recreational, educational and diving tourism purposes [8], and its smooth co-existence with other maritime activities.

At this stage, it is useful to clarify the very essence of UCH, being defined as a *non-renewable resource* comprising a set of *tangible and intangible* heritage items that are linked to past or present human activities in the sea [9]. More specifically, UCH is understood as the archaeological heritage which is in, or has been removed from, an underwater environment; and includes submerged sites and structures, wreck sites, and wreckage and their archaeological and natural context [10]. UCH, in this respect, may refer to remnants of human settlements and civilizations in the sea, such as sites of archaeological interest or sunk martial equipment, ancient harbors and ship or plane wrecks, to name a few; and encounters to approximately 3 million worldwide [11]. It is perceived as a *capsule in time*, delivering important historical and other kinds of information about the past. When associated with human loss, as in case of UCH from World War (WW) I or II (e.g. ship and plane wrecks), UCH is also considered as a site of remembrance; and a site that bears witness to significant instances of the European history, being thus part of the Europe's identity and historical trajectory.

A resounding example of areas exhibiting a large potential as maritime battlefield tourism destinations are many *insular regions* in the Mediterranean Sea. This is due to the UCH evidence lying on their coastal and surrounding maritime areas, being the outcome of their role as important WW I and II scenes. However, despite their cultural but also natural richness and diversity, islands in general and a large number of Mediterranean islands in particular are perceived as disadvantaged, fragmented and isolated areas, and distinct examples of lagging behind spatial entities at the European scale [8, 12]. This is due to a range of inadequacies, briefly summarized under the term *"insularity"* [12] and mainly relating to: the location of islands in the state's periphery; the confined geographical space and resource availability; the declining population pattern marked by aged, of low educational profile and digitally illiterate inhabitants; the lack of economies of scale, delimiting potential of local economy; the geographical fragmentation, associated with insufficient infrastructure provision for serving population's basic needs.

Insularity, however, can also be perceived as a *comparative advantage* of insular territories, broadening their attractiveness as peaceful and qualitative, authentic and experience-based cultural tourism destinations. The usually exceptional cultural profile of such regions comprises an *amalgam of tangible and mostly intangible, land and underwater, natural and cultural elements*, a legacy that is backed to the ancient but also recent history; and is the outcome of the enduring interaction of local culture and society with externally imposed events (war occupation and involvement, location as nodes in the Mediterranean historical merchant sea routes, etc.). Land CH and particularly the largely underexploited UCH can leverage sustainable development trails and remove isolation by building up competitive and attractive (U)CH-based *narratives* and respective *brands* and place them as niches in the rapidly specializing tourism market.

Along these lines, the *goal* of this article is to open up an intriguing new theme for planners, i.e. (U)CH and manifest its role for paving smart and sustainable, heritage-led development of less-privileged insular territories in the Mediterranean. Towards this end, in Sect. 2, a review of the current policy and legal considerations of UCH management is carried out, delineating the decision-making environment; Sect. 3 provides evidence as to the UCH wealth of the Mediterranean and its potential for coastal and insular communities; in Sect. 4 the convergence of ICT and (U)CH management is sketched, elucidating also ICT and non-ICT enabled barriers applying to (U)CH planning endeavors in insular regions; while finally in Sect. 5 some conclusions are drawn.

2 Legislative and Policy Considerations of UCH Management

UCH preservation and sustainable exploitation is a rather *"wicked"* planning problem [13], fraught with difficulties and new challenges for planners and policy makers. These are mainly emanating from the: specific attributes of the UCH surrounding environment raising, among others, *jurisdictional issues* and *risks* that threaten UCH to loss, e.g. climate change impacts; multiple, occasionally controversial guidance, of *institutional actors* (from national to global) having a 'say' as to the UCH preservation and

exploitation, revealing the necessity for *UCH governance*; *multi- and interdisciplinary nature* of this heritage, incorporating environmental, cultural, historical, social, economic and technological dimensions; value attached to UCH at different value systems; need to approach UCH in conjunction with land CH for embedding this to the wider spatial and cultural context and creating added value, especially in remote insular communities [13].

UCH policy decisions need, among others, to be in alignment with complex, *legislative considerations on a global scale*, as these are expressed by international Conventions with reference to both the surrounding environment of UCH, i.e. the sea, and the UCH per se. These considerations are, at present, predominantly demarcated by the [13]:

- *1982 United Nations Convention on the Law of the Sea* [14]: The most comprehensive international legal document, exclusively dealing with maritime issues [15]. It elucidates aspects of nations' rights and responsibilities as to the use of world's oceans and seas, thus indirectly conditioning policies for UCH protection. It disentangles the meanings of warships and their sovereign immunity on high seas. However, it deals exclusively with tangible underwater heritage, leaving aside the equally important intangible UCH dimension.
- *1992 European Convention on the Protection of the Archaeological Heritage* (Valetta or Malta Convention) [16]: It mainly addresses issues such as the protection of archaeological heritage as a source of the European identity and a resource of historical/scientific glow, and the consideration of archaeological interests in spatial planning endeavours, to name a few.
- *1996 Charter on the Protection and Management of Underwater Cultural Heritage* [10]: A supplement of the ICOMOS Protection and Management of Archaeological Heritage of 1990. It outlines the fundamental principles for UCH conservation. It addresses a variety of issues such as research objectives; investigation, documentation and material conservation; management and maintenance of a UCH site. It fosters public awareness for grasping the value of UCH and its preservation.
- 2001 *UNESCO Convention on the Protection of Underwater Cultural Heritage* [17]: A bedrock for the preservation of sunken heritage, providing location-specific guidelines to interesting member states. It constitutes the international protection framework for UCH *older than 100 years*. It sheds light on the essence of UCH and the types that are given cultural importance. It also clarifies the rights of flag states to excavate and preserve these vessels beyond their territorial waters. It goes beyond the UNCLOS Convention in order for the rights/duties of the coastal state and/or flag nation to be set out, according to the sunken UCH location.
- *Convention for the Safeguarding of the Intangible Cultural Heritage* [18]. Recognition of the value of intangible CH as a vehicle for building identity and social cohesion, providing communities with a sense of continuity, while promoting respect for cultural diversity and human creativity.

Legislative considerations with regard to UCH protection and management are complemented by a range of recent European policy directions. These, although depicting a *sectoral* (e.g. tourism, culture) or *spatial* (e.g. blue growth and marine spatial planning) orientation, they enhance opportunities for UCH sustainable

exploitation and management. To start with, the sectors of tourism and culture or more precisely the *'tourism and culture complex'* has been placed as an important pillar of the Regional Innovation Strategy for Smart Specialization (RIS3); and a locomotive for urban and regional development at the European Union (EU) level. In support of this complex, a bundle of policy guidelines is established at this level. With regard to tourism, the main corps relate to the "Agenda for a Sustainable and Competitive European Tourism" [19] and the "Europe, the World's No 1 Tourist Destination—A New Political Framework for Tourism in Europe" [20]. These are further reinforced by culture-specific policy directions, mostly articulated during the last decade. Such directions incorporate the: "Europe 2020" Strategy [21]; "Convention on the Value of Cultural Heritage for Society" or Faro Convention [22]; "European Agenda for Culture in a Globalization World" [23]; "Communication towards an Integrated Approach to Cultural Heritage for Europe" [24]; and the recent Work Plan for Culture 2019–2022 [25]. The importance of *public participation* is fully addressed in these documents, while the role of *culture* for public empowerment and social cohesion as well as for leveraging local development endeavors is also appreciated.

A further step forward for UCH management relates to the EU *Blue Growth Strategy* [26], stressing the importance of emerging sea-related economic opportunities. This strategy is complemented by dedicated spatial planning tools, namely the *Marine Spatial Planning* (MSP) [27] and the *Integrated Coastal Zone Management* (ICZM) [28] for effectively handling the spatial aspects of these opportunities. Blue Growth Strategy and related spatial planning tools bring on board new perspectives for the sustainable exploitation of maritime resources, including UCH. They also imply new obligations for planners, i.e. the imperative to place UCH within the framework of MSP and ICZM, in order for conflicting to UCH maritime uses to be properly handled. Finally, they also introduce new, highly supportive to UCH preservation and management concepts, such as *'territorial governance'*, *'consultation'* and *'public participation'*, *'place-based approach'*, and *'ecosystem-approach'*.

3 The Mediterranean Sea – a Densely UCH Populated Region

Mediterranean is one of the most important *"theatres"* of great, land and maritime, martial events of WWI and particularly WWII in Europe [29]. The strategic geographical position at the crossroad of three continents has rendered this region a pivotal war operations' scene; and a main sea transport route for raw materials and troops during WWI and II [30]. Commercial activity in the Mediterranean sea routes, shipping fatalities, war occupations, but also martial activity of WW I and II have left their 'signs' in the Mediterranean, in the form of both *land remains* (e.g. batteries and military installations) and *sunken remnants* (e.g. ship and plane wrecks) that are dated back to the ancient but also the recent history. These remains are largely unknown to the wider public and not fully explored and documented, constituting thus parts of '*a story yet largely untold'* [13:20]. They also are highly valued by local communities, being in many cases inseparable parts of this story, and distinct elements of the European identity and history, while attracting also interest as World Cultural Heritage sites.

Scattered throughout the whole Mediterranean Sea, UCH is a finite, irreplaceable and quite fragile part of CH. Its value varies, based on the causes of submerging, the wrecks' location and depth, their type (warships, aircraft, submarines, cargo, etc.), nationality, bonds to local communities, linkages to human losses, etc. [13, 31]. Speaking of WWI and especially WWII ship and plane wrecks, while abundant in the Mediterranean Sea, they are partially explored, with the majority of them lacking information as to the exact location and depth, current status and specific characteristics [8, 32]. Furthermore, their exact *number* is still unknown. It is worth noticing that 1,061 shipwrecks are reported as being sunk during WWII in the Aegean Sea, Greece; 500 of which were under a Greek flag [32].

In the Mediterranean Region there are few, albeit quite important, *WWI UCH* sites, closely related to famous naval battles [33], well-documented, and sustainably exploited as diving tourism destinations. Additionally, *WWII*, as the most geographically widespread military conflict the world has ever seen, has left a vast number of sunken military UCH [13]. A large share of these UCH remnants is located in the Mediterranean waters, scattered around the shores of Croatia, southern France, Greece, Italy, Malta, and North Africa; and witnessing important naval warfare under the *'Mediterranean Theater'*.

Promoting and protecting UCH in general and historical ship & plane wrecks in particular seems to gain importance as a lever for tracking and preserving European historical paths and identity; and tracing heritage-led local development of remote and isolated coastal and insular regions. The latter can be achieved by means of *cultural* and most importantly *diving tourism*, where entertainment UCH-related activities constitute a 'vehicle' for educating people in past failures and providing access to historical evidence. Cultural and diving tourism is also expected to have an economic counterpart, emanating from the rating of diving tourism as the second most attractive tourist sport activity worldwide [34]. As distinguished examples of diving tourism destinations in Europe can be mentioned sites located in the *French coastline*, featuring numerous restored wrecks (Le Donator Wreck-Fig. 1), diving parks and underwater protected areas; diving destinations in *Spain* and in particular at the *Mendes Islands*; submerged WWII battleships in *Malta* (Fig. 2) [35]; UCH in *Croatia*, where 400 submerged and 100 sites are listed as protected CH, to name a few.

As opposed to the above successful examples, the majority of wrecks in the Mediterranean and even worldwide do not receive that kind of attention. In fact, less than 10% of the globally submerged shipwrecks have been surveyed or visited by divers [11]. In the UCH wealthy Mediterranean Region in particular, heritage-led development prospects seem to be rather fragmented and immature. Same holds for UCH in the *Greek territory*, encompassing outstanding ancient but also wars' shipwrecks, such as the one located in Antikythera island [36]; the 58 shipwrecks recently discovered in the neighborhood of Fournoi island [37] being the *shipwreck capital of the world*, as noticed by Koutsouflakis and Campbell, marine archaeologists working on the field; the Destroyer 'Queen Olga' in Leros island [8]. These, although perceived as the largest shipwrecks in the Mediterranean, remain unexplored, unexploited and, most importantly, *unprotected*. The lack of reliable and accurate data, the 'silo' approach adopted by archaeologists [13], and the lack of MSP [3] appear as major constraints, preventing their sustainable exploitation.



Fig. 1. Le Donator" wreck in France, Source: [38]



Fig. 2. The Blenheim Bomber in the Maltese Archipelago Source: [35]

4 ICT-Enabled Management of UCH in Mediterranean Insular Communities: A Conditionally Win-Win Marriage

In this section, the potential of ICT for UCH management is roughly presented; while are also explored ICT and non-ICT related barriers appearing in the context of heritage-led (U)CH developmental planning endeavors in insular regions.

4.1 Tracking ICT Potential for Unfolding UCH Narratives in the Mediterranean

In the current, globally wired, environment, cities and regions are challenged to constantly deliver better, creative, innovative and qualitative products and services by making use of the Internet and ICT-enabled developments. These developments have also opened up new opportunities for remote and disadvantaged insular communities enabling them, under certain conditions, to enter the rapidly changing geography of cultural tourism destinations and the evolving cultural tourism market; and establish own niche markets, based on their distinguishable cultural assets. The role of technology though is not exhausted in simply marketing insular regions as cultural tourism destinations. On the contrary, it is traced to all the way from surveying, identification, exploration and visualization, as well as documentation and preservation of cultural assets, including UCH, to the process of place- and culture-based narrative building as well as commodification of narrative aspects into experience-based cultural products for destination marketing purposes (Fig. 3). A short discussion of the role of technology in each of these stages is following, having at its heart the UCH context.

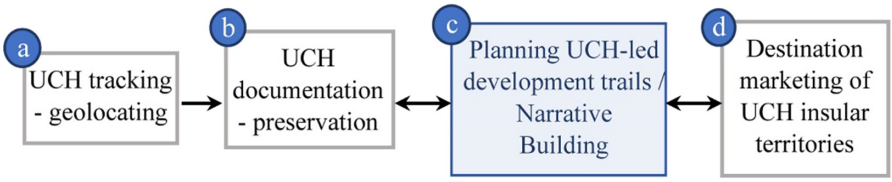


Fig. 3. ICT-enabled stages for promoting insular regions as UCH destinations

Tracking UCH is a complex task, mainly due to the lack of adequate knowledge as to its exact location within a largely unexplored environment, the marine one. Same holds for its documentation and preservation, taking into account the surrounding environment of a UCH site and the preservation obstacles this entails.

Speaking of the *Mediterranean Region*, despite the large number of sunken vessels located in its seabed, their exact location is yet unknown. Geo-locating UCH deposits is a first step in order for documentation, preservation and monitoring, risk assessment and sustainable exploitation of UCH sites to be advanced. This can nowadays be supported by state-of-the-art developments in *underwater technology*, which are capable of conducting UCH survey, identification, navigation, excavation, meticulously documentation, restoration and conservation [13]; while hull-mounted multi-beam sonar can provide high-resolution seafloor maps down to 90 m, thus enabling survey of UCH sunken in deeper waters. Moreover, high-quality UCH mapping and extensive photographical documentation is supported by various options and systems available, such as 3D LiDAR underwater laser systems, remotely operated vehicles (ROV) [39], remotely controlled underwater robots, high-resolution acoustic sensors, like the synthetic aperture sonar (SAS) technology [40]. Underwater technology developments can be of substantial help for UCH tracking, surveying, documenting and monitoring, while they can also steer content creation for visualization and marketing purposes, bringing UCH much closer to interested audience for recreational purposes.

CH in general and UCH in particular, apart from major *economic drivers* for local development by linking traditions and historical paths to creativity and entrepreneurship, they are also by many grasped as the *nexus* between individuals and society [41], promoting social cohesion. In order this to be achieved, there is a need for a broader understanding by planners and decision makers of: its inseparable tangible and intangible attributes and their role for delivering a sense of identity and continuity [18]; its nature as a non-renewable resource; the social, economic, environmental and cultural implications of planning interventions for society; and the principal role that communities, as custodians of (U)CH and those having a profound connection with a certain (U)CH site, can play. This understanding goes hand in hand with the concept of *public archaeology* [42], stressing the importance of *community engagement* for awareness raising as well as empowering and engaging the public in addressing UCH preservation and sustainable exploitation concerns. Public engagement in (U)CH management is already early highlighted in the 2001 UNESCO Convention (Rule 35 of the Annexes). It is further stressed by the Shanghai Charter in 2002, recognizing (U)CH insights of local communities as irreplaceable; and placing them as equals in decision-making processes questioning the way this heritage should be perceived and interpreted, valued and managed, as well as conveyed to others. Community engagement as the current paradigm in planning endeavors is not just useful, it is rather indispensable when (U)CH is concerned. This especially holds true in planning exercises that have as a spatial reference battlegrounds and/or places where historical events have occurred. Localized knowledge or voices of local people, who witnessed or even were part of these events is crucial for building meaningful and respectful cultural narratives as well as respective policies for preserving and promoting these places as cultural tourism destinations. This implies the adoption of *participatory decision-making models* in order for the multi-actor interests, values, expectations etc. to be fully embraced in (U)CH management.

Participatory or community-based planning endeavors for the sustainable exploitation of UCH place effort in identifying the peculiar meanings endowing tangible UCH elements, such as a ship or a plane wreck, i.e. integrating the UCH intangible dimension; and properly embedding these meanings in the planning process and outcomes. Furthermore, an *integrated approach* of tangible and intangible UCH elements, but also of maritime and land remains of historical events, such as WWI and II at a certain location, can broaden understanding and value of (U)CH in the planning process; and support cultural empowerment and awareness, responsibility and ownership of this heritage by local communities. It can also encourage engagement in *co-creating* place- and human-centric, value-respectful (U)CH-based narratives, which successfully integrate past into present for the current and future generations. Finally, it can support the *collective construction* of UCH-based cultural tourism products, embracing different perspectives and forms of local knowledge and enriching visitors' experience.

Currently, ICT and their applications have led to a *methodological revolution* of urban and regional planning approaches [43] and the digitalization of various stages of the planning process, giving rise to *e-planning*. This, among others, integrates spatial planning approaches and visualization techniques, while provides new potential for managing and visualizing, in meaningful for the local population ways, large spatial data sets [44]. ICT and their applications have also enabled the establishment of digital interaction among decision makers, planners and local communities, thus promoting *e-participation* and enriching the corps of planning knowledge through *crowdsourcing* remarkable and multidimensional local experiential knowledge. e-Planning and e-Participation have furthermore advocated the concept of *cultural governance*, giving rise to a range of ICT-enabled interaction means, such as online questionnaires or the more sophisticated Public Participatory Geographic Information Systems (PPGIS). The latter incorporates a range of mapping and participation techniques, ranging from ground mapping to participatory interpretation of remote sensing images, crowdsourcing online maps and data, networking, communication and partnerships' building [45]. E-Planning and e-Participation have been further popularized by the advent of *social networks*, presenting an exponentially growing e-interaction mean and a great chance for endorsing e-planning exercises. In case of *remote insular communities*, the aforementioned developments offer powerful tools for *removing insularity bottlenecks* in multiple ways, enabling also potential application of e-planning and e-participation approaches for widening e-engagement of local communities in planning UCH sustainable exploitation and management. They support also the use of visual media in the form of *maps and images*, accompanied with textual description, as an important *substitute of face-to-face interaction* in participatory planning endeavors.

Of importance is also the role of ICT in *marketing* insular communities as culturally-rich and peaceful destinations, by promoting in an integrated way, land and underwater CH. ICT have had a traditionally pervasive role in the tourist sector, a notably data-intensive industry. This role is nowadays further intensified, giving birth to the concept of *smart destinations* (SDs), i.e. places where the tourism sector is built upon a variety of harmonically interwoven cutting-edge technological applications and

exploitation of big data. These applications serve the establishment of bridges between demand and supply, the attainment of more informed decision-making at the destination level, the effective place-branding and marketing, to name a few. They also contribute to a better understanding of tourists' behavior, needs and choice influential factors; while attempting to promote destinations as innovative, modern places that make efforts to offer ICT-enabled visitors' experiences. Technological advances, such as Virtual Reality (VR) technologies, Augmented Reality (AR) models, three-dimensional (3D) reconstruction techniques or dedicated mobile phone applications at the service of visitors are perceived as powerful (U)CH marketing tools for coping with strong competition among destinations. They support attractiveness and act as an *accelerator* of newcomers' engagement and inclusiveness at a certain destination [41], both considered as issues of crucial importance for bolstering insular regions as synonymous of *seamless and accessible (U)CH experience-based personalized outputs*.

4.2 Barriers Identified in Planning (U)CH-Led Local Development in Insular Communities – Lessons Learnt from the Leros Case Study

Small Greek islands have played a major role during the WWI and especially WWII events, serving as grounds for martial operations and surveillance. As such, they were placed at the epicenter of important war incidents, leaving aside a rich historical heritage in the form of *sunken* and, in several cases, *land remnants*. Leros Island in the Aegean Sea represents a distinct example of WWII remembrance, evidenced by combined land and underwater remains. The island's trajectory throughout its history was marked by various occupations and martial activities. As the battleground of the famous *'Battle of Leros'* during WWII (1943), several important *ship and plane wrecks* rest in peace in Lakki Bay, while 14 non-protected wrecks (Fig. 4) are also scattered in the seabed around the island's coasts, all rendering the island as a whole an *immense UCH park*. The longstanding Italian occupation of Leros, being the biggest Italian aero-naval base in southeastern Mediterranean, has also left important *land remains* as inseparable parts of the Leros WWII narrative.

The authors of this paper have conducted a *participatory e-planning exercise* in an effort to sketch promising future pathways of Leros Island by coping, in an integrated way, with land and maritime WWII remains, coupled with elements of the island's natural heritage [see 8]. *Social networks* were used as a mean for engaging Leros community in this endeavor. Two spatially distinct and challenging future scenarios of Leros and related policy packages for local prosperity were communicated to Leros community through a Web-GIS (*Scenario A "From a 'Soul-House' to a place of Multiple-Opportunity"* and *Scenario B "Leros - An Open Museum of the European Cultural Heritage"*); and opinions, visions, attitudes, expectations etc. were gathered by local population for further improving and finalizing planning outcomes.



JUNKERS JU 52, sunk in the Battle of Leros

ARADO 196, German hydroplane

Destroyer 'Queen Olga', sunk the Battle of Leros

Fig. 4. WWII sunken remnants in Leros island, Source: [46]

Based on the previously described potential of ICT for unfolding WWI and II narratives in Mediterranean insular regions and the experience gained from the aforementioned e-planning exercise in Leros island, a number of ICT and non-ICT related *bottlenecks* are identified (Fig. 5) that restrain efforts in all four ICT-enabled stages for promoting insular regions as UCH destinations (Fig. 3). It should be noted here that discussion in the following leaves aside institutional and legislative barriers, emanating from lack of UCH governance at the global/national level as well as inconsistencies noticed between national laws and international conventions. On the contrary, it mainly focuses on *barriers applying at the local level* and more specifically on evidenced-based results emerging in a (U)CH-related cultural planning exercise in a specific insular territory, namely Leros, Greece.

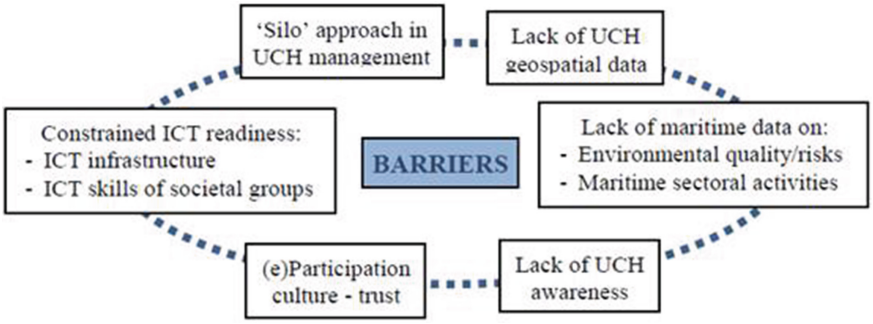


Fig. 5. ICT and non-ICT related barriers weakening effectiveness of planning endeavors towards (U)CH-led development in insular regions

To start with, a main obstacle is the *'silo' approach* so far prevailing in UCH management that places marine archaeologists as the main protagonists of such a task. This approach lacks a broader UCH management view, while largely ignores UCH potential as a valuable resource and a lever for delivering social cohesion and new economic opportunities. It also deprives UCH management from a fundamental first

step, being its *interpretation* [47], which calls for widening the viewpoints and valuing of UCH as well as strengthening the very essence of its management, i.e., imparting values and meanings this carries to society and future generations, and acting as a catalyst for social cohesion and identity building. Shift from a 'silo' to a more integrated, multi- and interdisciplinary, approach of UCH will fertilize ground for unfolding planning initiatives targeting UCH-led local development.

An important constraint is also the lack of *UCH geospatial data availability*, a critical aspect and the ground of any planning exercise. A comprehensive effort towards establishing a database that incorporates combined UCH geospatial and historical information, as well as documentation of already known UCH does not really exist; nor exists also a systematic effort towards the identification of historically known, but not yet geolocated UCH. A good example of this gap comes from Greece, where despite the abundance of information on UCH from a variety of sources, e.g. articles, books, international websites, oral stories and scuba divers' community, a spatial database, presenting in an integrated way available UCH data is lacking [32]. This partially emanates from the fragmented and uncoordinated efforts of various research groups engaged in the field. Current progress in geoinformatics but also in underwater technology seem promising developments for filling this gap for already known UCH; while they can support surveying of the yet spatially unidentified UCH. Linked to this gap is also the lack of *maritime data*, useful for making inferences as to the status and quality as well as carrying capacity of the surrounding environment of UCH and potential risks that may harm its status. This is a critical issue for UCH preservation especially in the Mediterranean, a highly vulnerable region to climate change, with unpredictable impacts on UCH condition and stability. Lack of *MSP studies* constitute also an important *gap* in the sense that incompatible to UCH maritime uses can threaten its status and preservation concerns.

Identifying, quantifying, and geographically locating UCH assets sets the ground for building up strategies and effective policies targeting societal, cultural and economic prosperity gains. Of great help in this respect is the enhancement of spatial data management and visualization potential in a GIS environment, coupled with Web developments that allow interactive Web-based GIS exploitation as a bidirectional interactive tool [48]. This, in conjunction with the potential offered by the advent of Web 2.0, enabling access to planning information and processes by a wide spectrum of actors through a variety of effective digital communication channels and visualization techniques, can broaden access to information and thus create new perspectives for participation and more *inclusive procedures in UCH management* to the benefit of both UCH and local communities. This was, to a certain extent, proven by the Leros participatory e-planning exercise, conducted by the authors of this work. However, this exercise has also unveiled a range of *barriers* in such a perspective, probably common in most remote insular regions. These relate to the lack of *awareness* as to the value of UCH for achieving social cohesion and local economic prosperity objectives, aspects that could constitute an attractive motive for population in less privileged regions for actively engaging in UCH preservation and responsible management and acting as safeguards of this heritage. Additionally, the aging population of island regions and the usually low level of its educational profile, coupled with the lack of *participatory culture* and *trust* to ICT-enabled interaction, are important obstacles. Finally, a major

barrier is the lack of *ICT skills* that largely impede local population to become part of an e-planning exercise and e-participation and to fully grasp relevant planning information, conveyed through a Web-GIS and distributed through various electronic means. This is critical, taking into account insularity and respective isolation this introduces, and the power of ICT-enabled interaction to remove insularity constraints; and is largely proven in Leros e-planning exercise. Despite all aforementioned difficulties however, all present in the Leros e-planning endeavor, it is worth noting the eagerness of local population of this remote island to overcome isolation and become part of initiatives targeting more inclusive, qualitative and heritage-led future development trails, with special reference to sustainable management of UCH.

5 Conclusions

Perpetual interest of humans through time in exploring the sea and using it as a main route for commercial purposes and cultural exchanges, but also as the ground of fatal martial events of the past, such as WWI and II, has left in the bottom of the world oceans, Mediterranean as well, more historical artefacts than all the museums of the world combined [49]. This justifies the worth for: shedding light on the abundant number of underwater historical heritage, laying largely unexplored and unprotected in the bottom of the seas; and taking steps for preserving and sustainably exploiting it to the benefit of the society as a whole. Speaking of the Mediterranean, preservation and sustainable management of WWI and II UCH is a two-sided coin, serving endurance of European identity, memory, and cultural heritage for future generations on the one side; and leveraging future cultural tourism trails of lagging behind and disadvantaged insular areas on the other [13]. The latter is further invigorated by the reviving interest in cultural and diving tourism as a remarkable *cultural turn* of contemporary travellers for satisfying *e*ntertainment, *e*xcitement, *e*ducation and *e*xperience objectives in a certain destination.

The Mediterranean Region, with its extended *coastal and insular territories* and the impressive, in terms of number and value, WWI and II UCH is a distinguishable, rather underexplored, example in such a context, and a challenging UCH-related narrative yet largely untold. Land and especially underwater CH can constitute a *key driver* for future development of such territories, especially for fragmented and remote insular communities, endowed with UCH and other land-related cultural and natural resources. However, viability and durability of future development of islands as storehouses of exquisite natural and cultural resources is fraught with a range of difficulties. ICT-enabled developments for effectively dealing with insularity drawbacks in general and sustainable exploitation of UCH resources in particular is a promising perspective in island territories. The latter seems that can be further enhanced by the currently favourable decision environment, which encourages blue growth development directions; facilitates well planned distribution of maritime uses for synergies' creation; and promotes community empowerment and engagement in decision-making processes. Based on these developments, but also the rapidly evolving cultural and diving tourism

trends and the competitive advantages of coastal and insular regions by means of cultural richness and diversity as well as global reach, future chances towards sustainable exploitation of (WWI and II) UCH for local developmental objectives can become a remarkable trend.

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