GIOVANNA GIULIA ZAVETTIERI - YASEEN AL-MULLA

GIS BASED SMART TOURIST DESTINATION APP FOR THE GOVERNORATE OF MUSCAT, OMAN

The evolution of geotechnologies in tourism – This article presents the final results of a post-doctoral project that entailed extensive research, data collection and rigorous analysis. The preliminary publications (Zavettieri 2021; Zavettieri, Morazzoni 2023) provided an overview of the context, objectives and expected outcome of the project, while this article presents definitive results.

The research presented emphasizes the importance of a holistic and inclusive perspective, where smartness is not limited to technological advancements, but rather revolves around the active participation and collaboration of various stakeholders, including the local community, in shaping the smart tourism ecosystem. This shift in focus to a socio-centric approach encourages the creation of more sustainable and community-oriented smart tourism initiatives.

Researchers (Bader et al., 2012) have emphasized that the intention to use mobile services in tourism strongly depends on their usefulness, ease of use, and social influence. In addition, intention is also associated with satisfaction with travel websites, according to No and Kim (2014). Furthermore, factors such as the cost of the information provided and the perceived usefulness of an app play a significant role in the adoption of a technological tool (Lai, 2015). This real-time geolocation capability empowers the tourist user to discover and access any noteworthy site, asset or service during their journey. At the same time, the geolocation of these sites, assets, or services finds its way to a broader audience through technological applications. This is particularly important for cultural heritage, which is sometime excluded from mainstream tourism circuits. Through digital innovation, heritage can now *fully* participate in the construction of new geographies of tourism.

The ongoing technological revolution in the tourism and cultural sectors has created and continues to create new ways of experiencing travel. These changes concern both geographical aspects, such as spatial organization, flow distribution, communication, and interaction with the territory, and economic

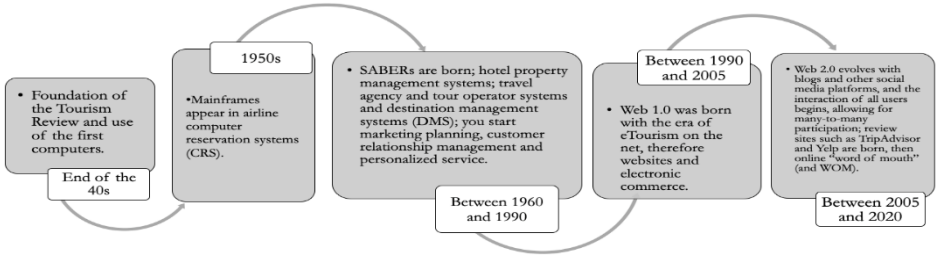
aspects, including the evaluation of local service quality, excellence, and implementation. These "smart experiences" revolve around technology-mediated initiatives that focus on personalization, location awareness, and real-time monitoring (Buhalis, Amaranggana, 2015). As a result, both the destination with its services and the tourists - active participants in creating a positive, enriching, and enjoyable experience - play a fundamental role in shaping, asserting, and enhancing the destination.

Since the late 1940s, technological advances have revolutionized tourism and cultural experiences (fig. 1), driven by the adoption of early computers and the formulation of new strategies (Buhalis, Law, 2008).

The continuous evolution of technology has significantly influenced the way tourists experience their travels and interact with cultural destinations. The combination of advanced technologies and innovative strategies has transformed travel into a personalized, dynamic and real-time experience where both the destination and the tourist actively contribute to creating and enhancing the overall tourist experience.

From the 1990s to the early 2000s, during the era of e-tourism, the advent of Web 1.0 introduced websites and electronic commerce (e-commerce) (Buhalis, 2003; Buhalis, Law, 2008).

Fig. 1 – *Tourism technology timeline over the past 75 years (1946-2020)*



Source: revised by Buhalis, 2020

With the emergence of search engines such as Google and web portals such as Yahoo, the online search for information was significantly transformed (Pan, Fesenmaier, 2006; Xiang, Wober, Fesenmaier, 2008; Paraskevas et al., 2011). Overall, technological advances have played a pivotal role in shaping the tourism industry, influencing the way travelers plan and experi-

ence their trips, while also changing the way businesses manage their operations and interact with customers.

The development of blogs and other social media platforms, such as online travel communities and social networks, marked the era of Web 2.0 and ushering in a new geography of communication (Buhalis, 2003; Buhalis, Law, 2008; Brás, Costa, Buhalis, 2010; Egger, Buhalis, 2011; Fotis, Buhalis, Rossides, 2011; Hays, Page, Buhalis, 2013) (2005-2015). This phase was characterized by connectivity and convergence, which became characteristic features of technology and facilitated interactions within the tourism and cultural ecosystem.

During this period, the tourism and culture ecosystem began to be conceptualized as an intelligent system that enables flexible communication, ubiquitous access to information, and serves the entire traveler lifecycle, creating new markets and value-added experiences. This increases connectivity and interactivity led to the creation of new markets and novel experiences, enriching the entire travel journey. As technology continues to evolve, it is shaping the way tourism and cultural experiences are designed, marketed and shared, fostering a dynamic and interconnected ecosystem with ever-expanding opportunities for tourists and stakeholders alike.

With the emergence of travel communities, *feedback processes* became increasingly important. User review sites such as TripAdvisor and Yelp allowed consumers to express their opinions through electronic word of mouth (eWOM), initiating a delicate mechanism for pre-evaluating not only airlines or tourism services, but also the destinations themselves. At this stage, the importance of building an ecosystem based on trust, scalability and openness towards tourists and services became apparent. This polysemic, heterogeneous, and open concept of place corresponds to a notion of culture that is more akin to a journey than to a fixed root (Cresswell, 2006).

In this context, places become relational spaces and contingent on the experiences of individuals and groups (Hubbard, Kitchin, 2010). Interactions and connections are further facilitated by the use of digital platforms that serve as hubs for sharing experiences, opinions, and recommendations. The digital landscape allows travelers to access a wealth of information and *user-generated content* that influences their decision-making and shapes their perceptions of destinations.

As a result, destinations are now seen as participatory and dynamic entities that can be co-created and re-imagined by tourists and stakeholders through active engagement and feedback mechanisms. This ongoing dialogue between

tourists, service providers and the destination itself fosters a deeper understanding of tourists' preferences and expectations, facilitating the creation of *personalized* and enriching experiences. By embracing this multifaceted and open concept of place, the tourism and cultural ecosystem can harness the power of technology to enhance interactions, enrich experiences, and promote sustainable and inclusive growth for all stakeholders. In this context, the COVID-19 pandemic was undoubtedly not a marginal phenomenon, but an epochal transition. Even after the state of emergency was lifted and life "in person" resumed, a return to the *status quo ante* was not envisaged.

Rather, the new digital and social configurations persisted, with digital assets governing real-world arrangements, an inversion in which digital arrangements determine real-world ones (Turco, 2021). This means that "being today" entails "being digital", constructing "identities, relationships, knowledge" (Paccagnella, Vellar, 2016; Morazzoni, Zavettieri, 2023) in a hybrid form, both online and in physical presence, without a clear-cut boundary between the two (Turco, 2021). Embracing this fluidity between physical and digital interactions, Ambient Intelligence (AmI) tourism has incorporated a range of disruptive technologies since 2020, such as the Internet of Things (IoT), the Internet of Everything, fifth-generation mobile networks (5G), Radio-Frequency Identification (RFID), mobile devices, smartphones, wearables (e.g., helmet cams and action cams), 3D printing, apps, cryptocurrencies, blockchain, sensor networks, pervasive computing, gamification, Artificial Intelligence (AI), and Machine Learning (ML)[1] (Tussyadiah et al., 2018; Buhalis et al., 2019; Afsahhosseini, Al-Mulla, 2020). This evolving digital ecosystem, supported by advanced technologies and intelligent systems, is reshaping the way people interact with tourism and cultural offerings.

However, while these technological advances offer numerous benefits, it is

[1] Although Artificial Intelligence (AI) and Machine Learning (ML) were mentioned in the paragraph, it is essential to note that their practical implementation was hindered by the unexpected challenges brought about by the COVID-19 pandemic. The pandemic necessitated a reconfiguration of our research dynamics, requiring us to operate in staggered shifts at the GIS research center located at Sultan Qaboos University in Muscat. Consequently, we shifted our focus to developing a prototype of a project segment using the powerful capabilities of GIS technologies and programming for application development. We had to adopt this adaptive approach due to urgent circumstances, highlighting the resilience and resourcefulness necessary for research undertakings during unprecedented challenges. However, we do not preclude the possibility of pursuing this second objective during a potential subsequent visit to the SQU.

essential to strike a balance between the digital and human elements to ensure that tourism remains sustainable, authentic and culturally sensitive. As the smart tourism landscape continues to evolve, it is critical to consider the ethical, social and environmental implications to create a future where technology-driven tourism enhances the well-being of both travelers and destinations.

With AmI, the tourism industry can leverage smart technologies to enhance the customer experience, optimize resource utilization, and improve overall efficiency. For example, through the use of IoT devices, travelers can receive personalized recommendations and real-time information about attractions, accommodations, and events based on their preferences and context. This creates a seamless and customized experience, allowing tourists to make more informed decisions while exploring a destination.

In addition, by leveraging digital platforms and smart systems, tourism businesses can access data on customer behavior, preferences, and feedback, enabling them to design more customer-centric offerings.

In this intelligent environment, mobile applications can provide tourists with real-time information as they explore the destination, including routes, points of interest, ongoing events, and personalized recommendations. This approach enables tourism management stakeholders to provide a more interactive and personalized experience for visitors, increasing their overall satisfaction and engagement with the destination (Zavettieri, Morazzoni, 2023; Zavettieri, 2021; Buhalis, Amaranggana, 2015; Gretzel et al., 2015; Neuhofer, Buhalis, Ladkin, 2014).

In light of the challenges highlighted by critical scholars of territorial smartness, further reflection can be made on the realization of a Smart Tourist Destination (STD)[2]. Mobile apps are therefore the most widely used smart tools in tourism to create real-time content and establish relationships between users and the territory. What distinguishes apps and some other smart objects -

[2] Smart tourism destinations have been tackled by many researchers including Anttiroiko et al., (2014), Anuar and Gretzel, (2011), Atzori et al., (2010), Bakıcı et al., (2013), Benckendorff et al., (2014), Bick et al., (2012), Boes et al.,(2015a), Boes et al., (2015b), Buhalis (2003), Buhalis and Amaranggana (2013), Buhalis and Amaranggana (2015), Buhalis and Law (2008), Dahlander and Gann (2010), Lopez de Avila (2015), Fesenmaier et al., (2006), Gretzel (2010), Gretzel (2011), Gretzel et al., (2015), Gutiérrez et al., (2013), Harrison et al., (2010), Hjalager (2002), Inversini and Masiero (2014), Lamsfus et al., (2014), Neuhofer et al ., (2015), Pollock and Williams (2009), Rudas and Fodor (2008), Sigala (2015), Sigala et al.,(2012), Wang and Xiang (2012), Wang et al., (2012), Werthner et al., (2015), and West and Gallagher (2006), Wöber (2003), Yoo et al., (2015).

such as smart kiosks and smart screens - from other tourism practices is their interactivity, which allows users to have more control over various aspects (Zavettieri, Morazzoni, 2023; Zavettieri, 2021).

Each tourist has preferences and needs related to all stages of the trip, from the location of the hotel to the type of meals they want to consume (Kennedy-Eden and Gretzel, 2012, p. 380; Zavettieri, Morazzoni, 2023; Zavettieri, 2021). However, the value of the tourist experience is not primarily generated by service providers, but rather by contingent processes. Therefore, destination services should cover the entire travel experience and not only the main aspects of the tourist's stay. Tourist experiences are multidimensional in nature and different engagements and factors throughout the trip (before, during and after) could also influence the overall experience (Stickdorn, Zehrer, 2009; Michopoulou, Buhalis, 2013; Buhalis, Amaranggana, 2015).

Therefore, an app should act as a mediator of the tourist experience (Buhalis, Amaranggana, 2015) to enable an experiential journey in the real physical environment. During the actual visit, tourists demand real-time information about attractions, accommodations, queue lengths, alternative attractions in case of bad weather, travel times, distances, working hours, access to emergency services (hospitals, ambulances, law enforcement), and necessary equipment depending on the type of itinerary. In addition, comparing feedback from other users is essential. Furthermore, unconventional destinations and their transportation systems can pose challenges to even the most adventurous travelers. These factors combine to create a tension between the desire to explore and the frustrations of travel (Buhalis, Amaranggana, 2015). Apps can provide updated information about geographic locations (of the user and tourist attractions), reviews of services (restaurants, hotels, cafes), types of rooms, prices, and information about surrounding events prior to the tourist's arrival. Tourists want targeted and relevant information to avoid being overwhelmed by too much information and to save time once they arrive at their destination. This indicates that they value the efficiency and personalization of the services offered during and even before their trip (ibid.). In summary, the digital tourism ecosystem allows tourists to extend their benefits beyond the tourism supply chain, with economic and social implications for the destination.

Oman, heritage and tourism. – Located on the southeastern coast of the Arabian Peninsula, the Sultanate of Oman features a diverse terrain, including extensive deserts, rugged mountains, and pristine coastline along the Arabian

Sea. The country spans approximately 309,500 square kilometers and shares borders with the United Arab Emirates to the northwest, Saudi Arabia to the west, and Yemen to the southwest. The geographic location of Oman plays a significant role in shaping its natural resources and climate. Vast deserts, such as the well-known Rub' al Khali (Rose, 2022), extend over the region's terrain, marked by undulating sand dunes and saline flats. The Al Hajar Mountains rise along their northern coast, renowned for their rugged beauty and exceptional geological formations (fig. 2). Oman's expansive coastline alongside the Arabian Sea and Gulf of Oman provides unspoiled beaches, striking cliffs, and islands that foster diverse marine ecosystems, while also sustaining vital fisheries. Dry riverbeds known as *wadis* crisscross the rocky landscape, producing lush oases in the arid environment.

Fig. 2 – *Map of the Sultanate of Oman*

Source: https://www.worldatlas.com/maps/oman

Despite the challenging climate, Oman accommodates a range of sturdy desert vegetation and exceptional wildlife species. Additionally, the country

has valuable mineral resources such as copper, limestone, and chromite, and it holds a significant position in the global oil and gas industry. These resources collectively support Oman's potential for economic development and its appeal as a tourist destination.

The population of the country is primarily concentrated in the northern region, comprising the capital city of Muscat and the mountain villages or intramountain valleys of Ad-Dakhiliyah Governorate. The National Center for Statistic and Information, Oman predicts the population in this region to reach 488,000 by 2021. This region provides a comfortable climate, indigenous flora, and agricultural potential. During the mild seasons, the lower temperatures spark an array of recreational opportunities like camping, hiking, and rock climbing.

The Al Hajar mountain range, located in the northern part of Oman, is an important part of the local geographical environment, not only because of its diverse native vegetation, but also because of the ancient agricultural practices and traditions that are still in use today. Specifically, Jabel Shams (Mountain of the Sun, 3,075 meters), the highest peak in the country, and the massive Jabel Akhdar (Green Mountain, 3,000 meters) are characterized by the presence of wadis, rocky boulders sculpted and shaped by erosion, and the typical *aflaj* (Al Ghafri 2007; 2008; 2018; Morazzoni, Zavettieri, 2022), ancient channels dug since time immemorial, and which are used to supply water for crops such as roses and garlic, to provide drinking water for the population in oases and villages, and to ensure the ablution ritual for the faithful near places of worship and mosques.

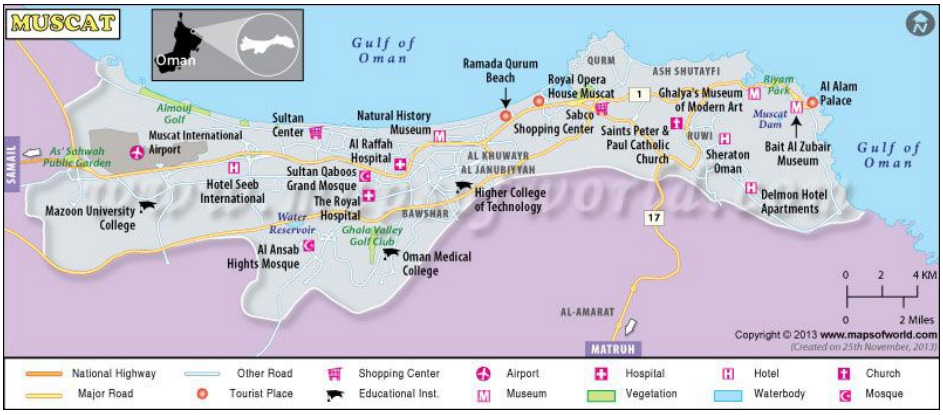
These practices and landscapes are of great cultural and ecological importance in the region. With the prospect of potential "tourist settlement" in the Omani mountains, the first issue to be addressed is the sustainable management of cultural heritage for residents, tourists, and visitors. The mountain is not just a material object characterized by physical attributes, but a complex system where environment and culture influence and shape tourism practices, leading to increasingly noticeable impacts on the landscape. Therefore, it is essential to include the experiences of both the local community and the tourists (as temporary residents) in the geographical reflection, as they contribute to the narratives of the territory: both memorial and grassroots narratives. This was the reason why, within the prototyped itineraries, the focus was also and above all on the Unesco sites on Omani territory.

Another reflection concerns the relationship between heritage, sustainability and luxury tourism. Luxury tourism, due to its focus on environmental sustainability, can be examined from a geographical perspective as a medium

that could contribute not only to the preservation of the mountain environment, but also to its regeneration (Luppis, 2016; Morazzoni, Zavettieri, 2023, pp. 29-30; Morazzoni, Zavettieri, 2022).

Although the mountains still have a strong influence on residents and tourists, the Governorate of Muscat, is the main center of tourist activity. Muscat, a city that has redefined its urban landscape in recent years, stretches along a coastline of about 50 kilometers, bordered by a mountain range inland (Zavettieri, Morazzoni, 2023). Within this geographical expanse, three distinct settlement areas have been identified, each of which has historical, cultural, recreational, and natural significance: 1. the district of Muttrah (souq and old port area, al-Alam Royal Palace, National Museum of Oman, Bait Al Zubair Museum, Muscat Gate Museum, Muttrah Corniche); 2. The city of new urbanization (from the airport for about 20 kilometers to the residential district of Qurum - which includes the Corniche of Shatti al Qurum - with the Royal Opera House and the emerging convention and exhibition district as well as a collection of beaches and hotel infrastructures proposed for tourist recreation); 3. The area of South Muscat, with unspoiled nature, beaches, international hotel chains and islands.

Fig. 3 – *Map of the city of Muscat*

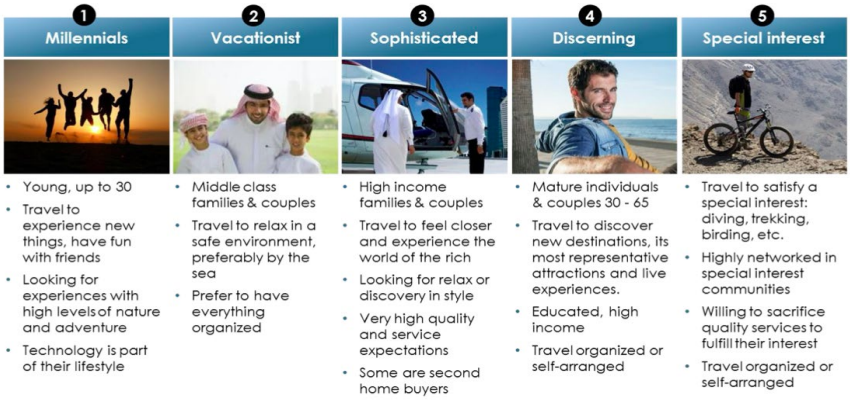


Source: https://www.pinterest.it/pin/281686151677078980/

These three areas represent the tourism offer of the governorate, which responds to a complex and articulated demand that can be summarized as cultural tourism, beach tourism, business tourism and leisure tourism (Zavettieri, Morazzoni, 2023; Zavettieri, 2021). In this tourism-urban context, residents are

also central to the current and future tourism development process, as there is a strong relational dimension of Omani society with the tourist. The local community is central to the Governorate's tourism development process for redevelopment projects, new tourism development plans, and marketing plans for the Muscat tourism destination (Zavettieri, Morazzoni, 2023; Zavettieri, 2021; Battaglia, 2019; Oman Vision 2040; Florida, 2003; Governa, 1997). Creativity, culture and environmental sustainability are thus the strategic assets of tourism in the Governorate of Muscat, which had an annual tourist flow of 2,121,000 in the pre-Covid 19 phase (Tourism Statistic Bulletin, p. 89). This is a diverse clientele (fig. 4): individuals, leisure, business and cultural travelers, but also families, high spenders, outdoor and nature-loving millennials traveling alone or in medium to large groups. In addition, sports enthusiasts will find a calendar of international events in the Governorate, ranging from sailing to kite surfing and horseback riding.

Fig. 4 – *Oman's target traveler profiles*



Source: Oman Vision 2040

As a unique geo-cultural environment, Oman offers ample opportunities to meet the growing demand for New Heritage and New Luxury tourism. The wealth of cultural heritage, ranging from licensed to bottom-up and new heritage practices, combined with the pristine and captivating natural environment, forms the core of the luxury experience. Research shows that the introduction of new heritage practices and the emergence of glamping are creating new tourism demand in the Omani mountains. New heritage and luxury tourism is attracting a young audience that finds joy and satisfaction

in being part of the decision-making process. This involvement fosters personal satisfaction, self-reflection, appreciation of local offerings, and a desire to connect with nature and the local community while contributing to sustainability (Morazzoni, Zavettieri, 2022).

In the pursuit of the project, during the validation phase we have proposed itineraries designed to incorporate local hospitality initiatives. These itineraries are strategically devised to expand the scope of luxury tourism, while concurrently intertwining environmental sustainability and enhanced opportunities for novel categories of tourists to engage with the local communities. Furthermore, our contemplation has extended to activities that resonate with the cultural inclinations of the host country and seamlessly cater to the preferences of Omani tourists, particularly the insiders, who have seen a surge in domestic tourism following the challenges posed by the Covid-19 pandemic.

Methodology. – The primary objective of this project was to develop a location-based mobile application tailored to the specific geographical context of the Governorate of Muscat, Oman. The application should provide valuable insights, information and interactive features for tourists and visitors exploring the region. The project was conducted at the Remote Sensing and Geographic Information System Research Center (RSGIS) at Sultan Qaboos University (SQU) in Muscat. The methodology used to develop the application involved a comprehensive approach, combining both desk and field analysis. The desk analysis phase consisted of collecting and collating various materials from various sources, including data processed by RSGIS, the Oman Ministry of Tourism, public organizations, maps, and information on the cultural and environmental aspects of the country.

Subsequently, the field analysis output was to assess the accessibility of specific natural resources, identify the resources to be integrated into the application's drone-generated paths, and evaluate the suitability of the tools available at the research center for this purpose. In addition, the field analysis played a crucial role in testing the practical feasibility of the proposed paths and their implementation within the application.

Figure 5 illustrates the phases of the work conducted in this study and is detailed as follows:

- A preliminary study has been the examination of the current regional tourism in the Governorate of Muscat. This study also identified geographical

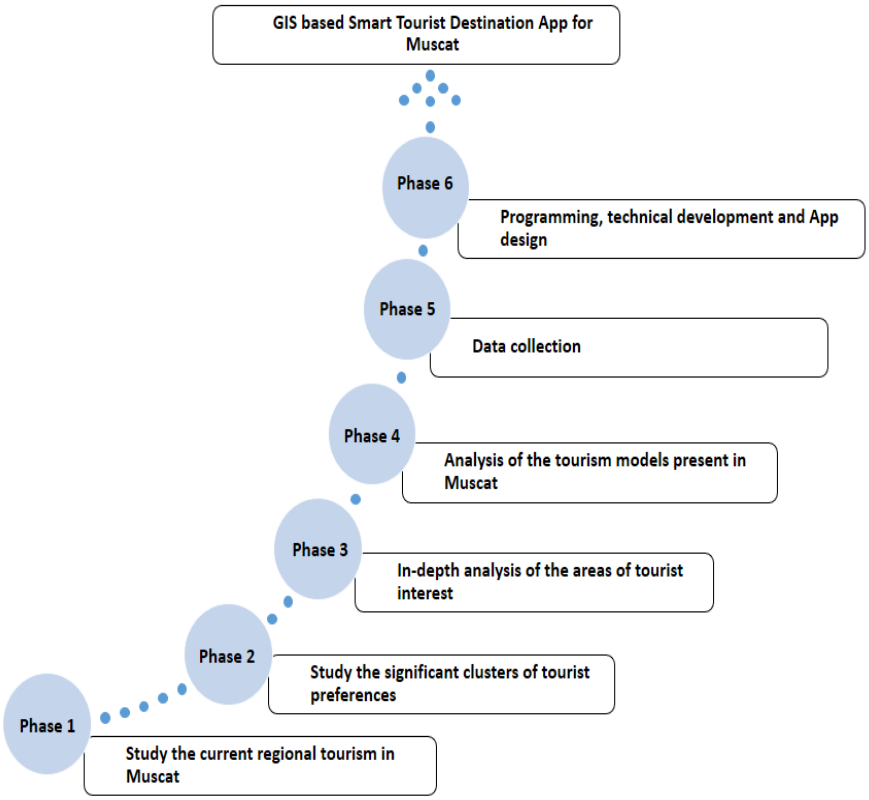
locations that have special tourist interest or popularity.
- Another preliminary study has been the identification of significant clusters of tourist preferences within the region.
- A detailed analysis was made of the areas of tourist interest, taking into account the presence and distribution of tourists. The analysis took into account the preferences expressed in the selection of resources and the socio-economic variables that influence the type of trip chosen.
- A comprehensive analysis of the tourism models present in the Governorate of Muscat was conducted, taking into account specific geographical variables. These variables included the types of resources, the level of sustainability of the tourism area, the types of accommodation facilities (both hotel and non-hotel), the infrastructure facilities, the public-private management of the area, the level of maturity of the tourism area, the level of accessibility of the localities, the free Wi-Fi coverage, the 4G coverage, and the technological progress of the tourism area.
- Data collection involved gathering information on both tourist and non-tourist resources and services. This data was applied using ArcGIS through CSV and Excel spreadsheets to create multi-level maps.
- Programming, technical development and the design of the app itself were the final stages.

The phases outlined represent a systematic approach to developing an informative and interactive mobile application that is tailored to the unique characteristics of the Governorate of Muscat, providing a more enriching and engaging experience for tourists and visitors exploring the region.

The comprehensive analysis of tourist areas of interest has enabled the identification of trends in the locations within the Governorate of Muscat that attract tourists. This process made it possible to identify the strengths and weaknesses of the sector's tourism policies. In addition, the analysis facilitated the identification of areas that are highly favored by tourists, those that have excellent tourism facilities, those that have significant strategic importance, as well as those that have limitations in terms of services, infrastructure, resources, and overall territorial organization.

By understanding these patterns and characteristics, policymakers and stakeholders can make informed decisions and implement targeted measures to enhance and develop the tourism sector in the Governorate of Muscat.

Fig. 5 – *Phases of the work*



Source: Author's elaboration

This data-driven approach can lead to the sustainable and balanced growth of tourism, maximizing its benefits while addressing the limitations and challenges that may exist in certain areas. Ultimately, this analytical process contributes to the overall improvement of the tourism experience and ensures the preservation and promotion of the natural and cultural heritage of the region (Zavettieri, Morazzoni, 2023; Zavettieri 2021).

An integrated destination management process is required to pursue a smart and sustainable growth model. This strategy involves gaining a deep understanding of the destination from a local perspective, creating a distinctive identity for the place, introducing pilot projects or pioneering initiatives, and strengthening the virtual identity of the destination. During the few site visits that it was possible to conduct shortly before and shortly after the Covid,

we were able to assess that digital technologies play a crucial role in this process, facilitating the sharing and preservation of the collective memory of the community. By leveraging digital platforms, the local community can effectively promote its territory by telling its unique story, targeting specific markets and innovating tourism products. A well-designed and technology-enabled approach to destination management promotes smart and sustainable growth, supports the preservation of natural and cultural assets, while ensuring the prosperity of the local community and providing meaningful and enriching experiences for tourists.

The chosen method of analysis was essential for the development of an app that meets the needs of tourism prosumers who want to 1) plan their trip according to their preferences, 2) make informed choices about accommodations, itineraries, and activities, and 3) access tools and services similar to those they use in their daily lives.

Furthermore, the communication channel created by the App serves to bridge the gap between tourists and the local community. This interaction allows visitors to engage more deeply with the destination, learn about the local culture, and support sustainable practices that benefit both tourists and the community. As tourists share their positive experiences, it creates a ripple effect of positive promotion, potentially attracting new visitors to explore the beauty and richness of Oman's Governorate of Muscat.

In summary, the app's mission goes beyond being a simple travel guide; it seeks to empower tourists, foster meaningful connections with the local community, and unleash the potential of user-generated content to engage a wider audience, ultimately contributing to the sustainable growth of tourism in the region.

This not only enhances the overall travel experience but also allows for the strategic distribution of tourist flows to minimize overtourism in sensitive areas and promote sustainable tourism practices.

As destinations cater to different interests and preferences, niche products have emerged, targeting specific segments of travelers and offering specialized experiences. This differentiation promotes sustainable tourism development while preserving the authenticity and uniqueness of each place.

In summary, the fusion of sustainable practices and advanced technology has given rise to an experiential and *participatory tourism model*. By transforming travelers into active protagonists, destinations can foster meaningful connections, promote responsible travel, and ensure the long-term conservation and enjoyment of their natural and cultural treasures. Indeed, as defined by Gretzel

et al. (2015), "smart experiences" in tourism revolve around leveraging technology to create tourism experiences that are personalized, context-aware, and monitored in real time (Buhalis, Amaranggana, 2015). By understanding the context in which tourists engage with the destination, the smart experience model enables the delivery of real-time and relevant information, enhancing the overall satisfaction and enjoyment of the journey. Through personalization, tourists become active co-creators of their travel experiences, playing a pivotal role in shaping the itinerary and choosing activities that resonate with their interests. This participatory engagement fosters a more profound and meaningful connection with the destination, as tourists become immersed in the local culture and actively contribute to the creation of positive memories. At the same time, the destination itself plays a crucial role in providing high quality and diverse services, infrastructure, and opportunities that align with the needs and desires of the travelers. The destination's commitment to delivering exceptional experiences further strengthens its appeal and ensures the sustainability of tourism development.

The design phase of the app took a comprehensive approach to ensure that it covered the full spectrum of tourism activities. This includes facilitating visits to culturally significant sites as well as exploring places of natural significance. Consideration was given to seasonality and related issues to provide tourists with optimal experiences at different times of the year. In addition, the utmost sensitivity to local culture was emphasized to ensure that the app's offerings respect and align with the values and traditions of the community.

By combining smart technology with a thoughtful consideration of the destination's cultural and environmental sensitivities, the app endeavors to provide tourists with a memorable and enriching experience that captures the true essence of the Sultanate of Oman. Indeed, scientific studies and case analyses confirm that tourists have diverse preferences and needs, ranging from accommodation choices to culinary preferences while traveling (Buhalis, Amaranggana, 2015). Tourist experiences are multidimensional in nature, influenced by numerous factors and interactions throughout the entire journey – before, during, and after the trip (Buhalis, Amaranggana, 2015; Michopoulou, Buhalis, 2013; Stickdorn, Zehrer, 2009). These experiences can be shaped by various stakeholders, including local communities, fellow travelers, cultural encounters, and unexpected events that occur along the way. As a result, an app designed for the destination should function as a mediator of the overall tourist experience (Buhalis, Amaranggana, 2015), facilitating an experiential journey within the physical environment.

The developed app represents a dynamic platform, empowered by GIS technologies, facilitating the seamless exchange of information on tourism activities while enhancing the decision-making process for travelers.

By incorporating GIS technology into the app, it becomes a powerful tool for tourists to access comprehensive and up-to-date information about the destination. With enhanced filtering capabilities and real-time updates, the app empowers travelers to make informed decisions, plan their itineraries efficiently, and immerse themselves fully in the rich cultural and natural heritage of Oman.

The app plays a critical role in offering information that helps identify potential issues and provides customized solutions to address them (Buhalis, Amaranggana, 2015). This is achieved through various features that enhance the overall travel experience and support tourists during their journey:

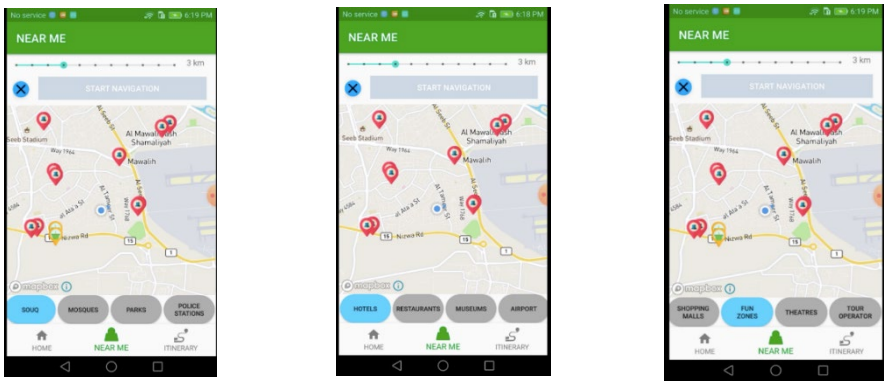
- "Emergency services information": The app provides essential information about the location and contact details of emergency services, including hospitals, ambulances, and law enforcement agencies. This ensures that travelers have access to immediate assistance in case of any unforeseen emergencies, promoting a sense of safety and security during their exploration.
- "Traveler preparedness": The app guides tourists on what essentials they need to carry with them during their itinerary to avoid being unprepared for specific conditions or activities. By providing tips on appropriate clothing, necessary equipment, and other essentials, the app empowers tourists to be well prepared for their journey, minimizing potential inconveniences.
- "Navigation assistance": Given that uncommon destinations like Oman, especially for tourists accustomed to European destinations, might present challenges with transportation systems, the app serves as a valuable navigation guide. It provides real-time navigation assistance, ensuring that travelers can navigate through the region efficiently and without unnecessary frustrations.
- "User feedback and reviews": The app allows users to provide feedback and leave reviews based on their experiences, which benefits other travelers. These firsthand insights from fellow tourists help others make informed decisions and plan their itineraries with greater confidence.

By offering these features and solutions, the app addresses the tension that can arise between the desire to explore unfamiliar destinations and the potential challenges associated with transportation.

Developed for the Governorate of Muscat, Oman, the app provides a dynamic platform, mediated by ICT and GIS technologies, that facilitates the exchange of real-time information on tourism activities and enhances the decision-making process for travelers. With the integration of GIS technology, the app provides various functionalities that improve the overall tourist experience. One of the key features is the availability of updated geographical maps covering the region, allowing users to access comprehensive and detailed information about various tourist attractions and points of interest. To ensure accessibility and usability for tourists, traditional paper maps have also been digitized.

App's structure. – The application is divided into two primary sections, with the first being "Near Me" (fig. 6). This section employs straightforward geolocation logic to determine the user's position within the Muscat Governorate. Subsequently, it presents the nearest tourist attractions, providing users with the ability to further refine the results based on their current location. The app features a variety of attractions on the interactive map, including Hotels, Restaurants, Museums, Airports, Archeological Sites, Beaches, Cinemas, Convention Centers, Sand Dunes, Fuel Stations, Health Centers, Hospitals, Islands, Souq, Mosques, Parks, Police Stations, Shopping Malls, Fun Zones, Theatres, and Tour Operators. Tourists have the flexibility to select the categories they wish to view on the map, and by clicking on the indicator for each site, they can access basic operational information and navigation advice directly through the app.

Fig. 6 – *Section of the app "Near me"*



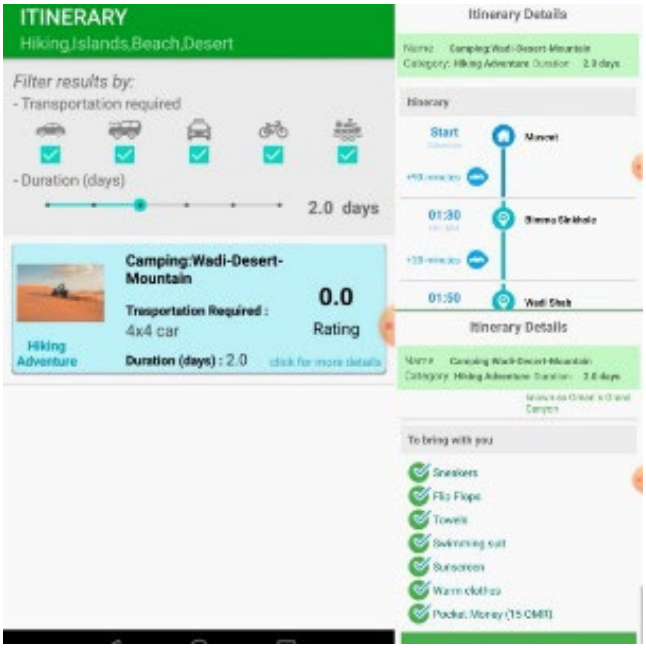
Source: Screenshot of the authors on the app

The second section of the app is the "Itinerary" (fig. 7), which allows tourists to personalize their trip while interacting with the territory. The app offers different types of itineraries to suit different tastes and interests. These include cultural, sporting, recreational, naturalistic, gastronomic and adventure routes. Tourists can explore the available options and choose itineraries that match their interests, enabling them to curate a unique and customized travel experience in the Governorate of Muscat, Oman.

The user engages with the application by selecting three key elements: route type, transportation type, and trip duration. Once the user has applied these filters, the application provides a curated list of itineraries that match the user's preferences. After selecting a specific route, the navigation process begins.

Throughout the journey, each stage of the route is accompanied by concise descriptions of the natural, cultural and recreational elements the user will encounter along the way. The itinerary provides both temporal distance information (in the itinerary details) and spatial distance information (during navigation), ensuring that the user is well informed about the duration and distances involved in the chosen journey.

Fig. 7 – *Section of the app "Itinerary"*



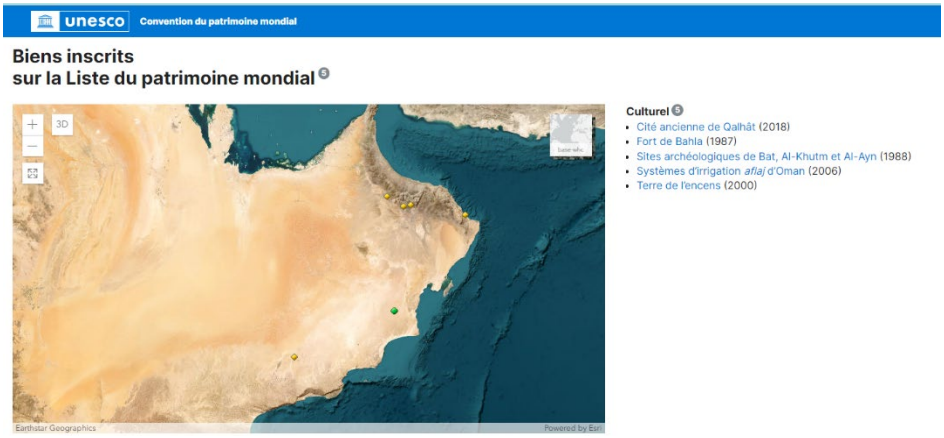
Source: Screenshot of the authors on the app

As the navigation unfolds, users are enriched with valuable insights into the various aspects of the destination, ensuring a rewarding and immersive travel experience. Indeed, maps play a fundamental role in the functionality of the app, serving as a cornerstone for understanding the territory. The integration of digitization processes applied to cartography enhances the app's smart capabilities, enabling users to access a wealth of valuable information about the region.

As a result, the app not only facilitates efficient navigation and exploration but also elevates the user's engagement and interaction with the territory. The seamless integration of smart cartography and augmented reality aligns with the broader trend of technology-driven advancements in tourism, enhancing the travel experience and promoting sustainable tourism practices in Oman's captivating Governorate of Muscat (Mangano, Ugolini, 2017). Another novelty of this research lies primarily in the updated itineraries, which have been tailored to reflect the evolving circumstances. These updated routes are a testament to the adaptability and responsiveness of the project to changing environmental factors and unforeseen events.

The application currently presents 25 accessible itineraries, mostly in the Northern region of the country. The justification for this lies in a couple of explanations. Firstly, this area accommodates the majority of the population. Secondly, there is a significant accumulation of UNESCO sites located in this region, as depicted in Figure 8. Furthermore, the ecological fragility of these areas accentuates the importance of involving the local community in tourism development efforts.

Fig. 8 – *UNESCO Sites in Oman*



Source: https://whc.unesco.org/fr/etatsparties/om

It is worth noting that the app demonstrates its dedication to inclusivity by retaining the Arabic language function. This encourages local Omani users to engage with their heritage by including Arabic toponyms. Additionally, these efforts aim to rekindle the Omani people's connection with their history, resulting in a better appreciation and respect for their cultural and historical legacy. This approach is critical as Oman experiences a consistent increase in visitor numbers, and there is a strong desire to preserve its uniqueness amidst this growth in tourism. By avoiding mistakes made in the West or certain Arab countries that have adopted a Western approach to tourism development (such as prioritising futuristic designs), utilising Arabic place names not only enhances one's understanding of the local culture but also immerses tourists in an atmosphere that embodies unique characteristics of the host country, thus enabling them to comprehend their surroundings better from a semantic standpoint.

Presented below are two illustrations of revised itineraries (refer to fig. 9).

Fig. 9 – *a*) "*Culture&Adventure itinerary*" *and b) "Hiking&Adventure itinerary"*

a)

b)

Source: Author's elaboration

Conclusions. – The overall objective of this project was to capture the true essence of tourism in the Governorate of Muscat and provide an app equipped with interactive tools to create a communication channel between users/consumers and the local community. In addition, the app aimed to trigger a viral sharing process, potentially through social networking sites, where users could share their experiences of Oman, thereby attracting and attracting new potential tourists to the region. By empowering tourists to actively shape their own itineraries and experiences, the app fosters a sense of ownership and personalization, increasing overall satisfaction and driving positive word-of-mouth recommendations. Through the app, tourists are empowered with the information and resources they need to make informed decisions and choose experiences that match their interests and preferences.

The app not only serves as a facilitator for users but also functions as a tool for the enhancement of cultural heritage.This project was conceived with the understanding that modern-day travel is not only an opportunity for leisure but also a means for tourists to express their sense of belonging and personal passions. The shift from a "tourism of objects" to a "tourism of meanings" highlights the motivational aspect of travel, necessitating a creative approach to designing the tourist experience (Del Vecchio et al., 2018).

The tourist experience is a result of the dynamic interaction between multiple elements: the tourists themselves, the various components of the tourism supply chain, the local community, and the destination, often referred to as the "setting." The setting represents the collective history and culture of the residents, and it also serves as the "container of services" that support the engagement of tourists. To create a truly memorable and enriching travel experience, it is essential to harness the distinct characteristics of the destination and its unique offerings. Building an "experience-scape" with tourists, rooted in the richness of the territory and its singularities, becomes the foundation for fostering meaningful and authentic connections (Mossberg, 2007). By embracing this approach, the developed app for the Governorate of Muscat, Oman, becomes more than a mere tool for navigation and information; it becomes a catalyst for crafting personalized and immersive experiences that resonate with the values and passions of each traveler. This alignment between the tourist and the destination leads to more profound and meaningful travel experiences, creating lasting memories and a positive impact on both the tourists and the local community.

Within this project, the setting, embodied by the captivating territory of the Governorate of Muscat in Oman, plays a paramount role in orchestrating an immersive and memorable entertainment experience for tourists. The territory's mix of attractiveness factors becomes the canvas upon which the consumer-tourist assumes the role of the "hero of history". Here, the local community, with its rich array of distinctive landmarks and cultural references, takes on the role of the "narrative universe" (Ryan, 2009; Albanese, Graziano, 2020) that eloquently recounts the region's nature, traditions, customs, and way of life.

The app serves as an integral "magnetic device", effectively capturing and engaging the attention of users while facilitating their cognitive exploration of the destination. In doing so, it fosters a profound understanding and appreciation of the territory's intricacies and allure. Additionally, the app provides a comprehensive and holistic perspective, meticulously framing the various elements of the territorial offer and involving a diverse array of stakeholders in a collaborative process of co-value creation with the Governorate of Muscat.

Emphasizing a participatory and bottom-up approach, the app introduces users to the territory's multifaceted attractions, empowering them to become active contributors in the promotion of Oman's destination. Through the sharing of images and selfies on online social platforms, a dynamic process of online and offline word of mouth is ignited, further elevating the destination's

image and fostering emotional connections with travelers from different cultural backgrounds.

In this continuous process of co-creation, the app serves as a catalyst for shaping and nurturing the territorial identity, natural landscapes, cultural heritage, and local traditions, transforming them into meaningful and enduring tourist experiences to be cherished and preserved.

REFERENCES

AFSAHHOSSEINI F., AL-MULLA Y., "Machine learning in tourism", *Proceedings of the 2020 3rd International Conference on Machine Learning and Machine Intelligence,* 2020, pp. 53-57.

ALBANESE V., GRAZIANO T., *Place, cyberspace e le nuove geografie della comunicazione. Come cambiano i territori per effetto delle narrazioni online*, Bologna, Bologna University Press, 2020.

ALBINO V., BERARDI U., DANGELICO R. M., "Smart Cities: Definitions, Dimensions, Performance, and Initiatives", *Journal of Urban Technology*, 2015, 22, 1, pp. 3-21.

AL-GHAFRI A., "Overview about the Aflaj of Oman", *Proceeding of the International Symposium of Khattaras and Aflaj, Erachidiya, Morocco 9 October 2018 Overview*, 2018, pp. 1-22.

AL-GHAFRI A. S., "Traditional water distribution in Aflaj irrigation systems: Case study of Oman", *What Makes Traditional Technologies Tick? A Review of Traditional Approaches for Water Management in Drylands*, 2008, 74.

AL-GHAFRI A., INOUE T., NAGASAWA, T., "Irrigation Scheduling of Aflaj of Oman", *University of Hokkaido*, www. inweh. unu. edu/inweh/drylands/Publications/AlGhafri. Pdf, 2007.

ANTTIROIKO A. V., VALKAMA P., BAILEY S. J., "Smart cities in the new service economy: building platforms for smart services", *AI & society*, 2004, 29, pp. 323-334.

ANUAR F., GRETZEL, U., "Privacy concerns in the context of location-based services for tourism", *ENTER 2011 Conference*, 2011.

ATZORI L., IERA A., MORABITO G., "The internet of things: A survey", *Computer networks*, 2010, 54, 15, pp. 2787-2805.

BADER A. AN OTHERS, "Mobile tourism services and technology acceptance in a mature domestic tourism market: the case of Switzerland", in FUCHS

M., RICCI F., CANTONI L. (Eds), *Information and Communication Technologies in Tourism 2012*, Vienna, Springer-Verlag, 2012, pp. 296-307.

BAKICI T., ALMIRALL E., WAREHAM J., "A smart city initiative: the case of Barcelona", *Journal of the knowledge economy*, 2013, 4, pp. 135-148.

BATTAGLIA A., "Gli emergenti distretti turistici nel Sultanato dell'Oman: il caso di Mascate", *Semestrale di studi e ricerche di geografia*, 2019, 2, pp. 7-21.

BERRY C. R., GLAESER E. L., "The Divergence of Human Capital Levels across Cities", *Papers in Regional Science*, 2005, 84, 3, pp. 407-44.

BICK M. ET AL., "Value-in-use of mobile technologies", in BACK A. AND OTHERS (Eds.), *MMS 2012*, 2012, Bonn, Köllen Druck & Verlag, pp. 56-67.

BOES D., BUHALIS A., INVERSINI A., "Conceptualising smart tourism destination dimensions", in TUSSYADIAH I., INVERSINI A. (Eds.), *Information and communication technologies in tourism*, Springer, Cham, 2015, pp. 391-403.

BOES K. ET AL., "The Acceptance of NFC Smart Posters in Tourism", in TUSSYADIAH I., INVERSINI A. (Eds.), *Information and Communication Technologies in Tourism 2015*, 2015, Heidelberg, Springer, pp. 435-448.

BOES K. ET AL., "Conceptualising Smart Tourism Destination Dimensions", in TUSSYADIAH I., INVERSINI A. (Eds.), *Information and Communication Technologies in Tourism 2015*, Heidelberg, Springer, 2015b, pp. 391-403.

BRÁ J.M., COSTA C., BUHALIS D., "Network analysis and wine routes: the case of the Bairrada Wine Route", *The service Industries Joural*, 2010, 30, 10, pp. 1-21.

BUHALIS D., *eTourism: information technology for strategic tourism management*, London, Pearson, 2003.

BUHALIS D. AND OTHERS, "Technological disruptions in services: lessons from tourism and hospitality", *Journal of Service Management*, 2019, 30, 4, pp. 484-506.

BUHALIS D., AMARANGGANA A., "Smart tourism destinations", *Information and Communication Technologies in Tourism 2014", Proceedings of the International Conference in Dublin, Ireland, January 21-24th, 2014*, 2013, pp. 553-564.

BUHALIS D., AMARANGGANA A., "Smart tourism destinations enhancing tourism experience through personalisation of services", *Information and Communication Technologies in Tourism 2015: Proceedings of the International Conference in Lugano, Switzerland, February 3-6, 2015*, 2015, Springer International Publishing, pp. 377-89.

BUHALIS D., LAW R., "Progress in information technology and tourism management: 20 years on and 10 years after the Internet-The state of eTourism research", *Tourism management*, 2008, 29, 4, pp. 609-623.

BUHALIS D., LEUNG D., LAW ROB L. R., *eTourism: critical information and communication technologies for tourism destinations*, CABI International, 2011.

BUHALIS D., SINARTA Y., "Real-time co-creation and nowness service: lessons from tourism and hospitality", *Journal of Travel & Tourism Marketing*, 2019, 36, 5, pp. 563-582.

BUHALIS D., "RICIRMS as a strategic tool for small and medium tourism enterprises", *Tourism Management*, 1993, 14, 5, pp. 366-378.

COHEN E., "Southeast Asian Ethnic Tourism in a Changing World", *Asian Anthropology*, 2012, 7, pp. 25-56.

COLLINS G.R., COBANOGLU C., *Hospitality Information Technology: Learning How to Use It*, Kendall, Hunt Publishing, 2013.

CRESSWELL T., *On the move: mobility in the modern Western World*, New York, Routledge, 2006.

DAHLANDER L., GANN D. M., "How open is innovation?", *Research Policy*, 2010, 39. 6, pp. 699-709.

DE FALCO S., LA FORESTA D., "Il patrimonio culturale in epoca 4.0: una nuova geografia dello sviluppo turistico"*, Annali del turismo*, 2017, VI, pp. 39-58.

DEL VECCHIO P. AND OTHERS, "Creating value from social big data: Implications for smart tourism destinations", *Information Processing & Management*, 2018, 54, 5, pp. 847-860.

DENG R., BENCKENDORFF P., GANNAWAY D., "Understanding learning and teaching in MOOCs from the perspectives of students and instructors: A review of literature from 2014 to 2016", *Digital Education: Out to the World and Back to the Campus: 5th European MOOCs Stakeholders Summit, EMOOCs 2017, Madrid, Spain, May 22-26, 2017, Proceedings 5*, 2017, pp.176-181.

EGGER R., BUHALIS D. (Eds.), *Etourism case studies* London*,* Routledge, 2011.

FESENMAIER D., WERTHNER H., WÖBER K., *Destination Recommendation Systems: Behavioral Foundations and Applications*, Cambridge, CAB International, 2006.

FLORIDA R. L., *L'ascesa della nuova classe creativa. Stile di vita, valori e professioni*, Milano, Mondadori, 2003.

FOTIS J. N., BUHALIS D., ROSSIDES N., *Social media use and impact during the holiday travel planning process*, UK, Springer, 2012.

GOVERNA F., "Il milieu urbano come fattore di differenziazione e di sviluppo", in DEMATTEIS G., BONAVERO P. (Eds.), *Il sistema urbano italiano nello spazio unificato europeo*, Bologna, Il Mulino, 1997, pp. 299-345.

GOVERS R., GO F. M., "Projected destination image online: Website content

analysis of pictures and text", *Information Technology & Tourism*, 2004, 7, 2, pp. 73-89.

GRETZEL AND OTHERS, "Conceptual foundations for understanding smart tourism ecosystems", *Computers in Human Behavior*, 2015, 50, pp. 558-563.

GRETZEL U., "Travel in the Network: Redirected Gazes, Ubiquitous Connections and New Frontiers", in LEVINA M., KIEN G. (Eds.), *Post-global Network and Everyday Life,* New York, Peter Lang, 2010, pp. 41-58.

GRETZEL U., "Intelligent systems in tourism: A social science perspective", *Annals of tourism research*, 2011, 38, 3, pp. 757-779.

GRETZEL U. AND OTHERS, "Tell me who you are and I will tell you where to go: Use of travel personalities in destination recommendation systems", *Information technology & tourism*, 2004, 7, 1, pp. 3-12.

GRETZEL U. ET AL., "Smart tourism: foundations and developments", *Electronic markets*, 2015, 25, pp. 179-88.

GUTIÉRREZ V. AND OTHERS, "SmartSantander: Internet of things research and innovation through citizen participation", in GALIS A., GAVRAS A. (Eds.), *The Future Internet*, Heidelberg, Springer, 2013, pp. 173-186.

HARRISON C. ET AL., "Foundations for Smarter Cities", *IBM Journal of Research and Development*", 2010, 54, pp. 1-16.

HAYS S., PAGE S. J., BUHALIS D., "Social media as a destination marketing tool: its use by national tourism organisations", *Current issues in Tourism*, 2013, 16, 3, pp. 211-239.

HJALAGER A. M., "Repairing innovation defectiveness in tourism", *Tourism Management*, 2002, 23, 5, pp. 465-474.

HOLLANDS R., "Critical Interventions into the Corporate Smart City", *Cambridge Journal of Regions, Economy and Society*, 2015, 8, 1, pp. 61-77.

HUBBARD P., KITCHIN R. (Eds.), *Key thinkers on space and place,* New York, Sage, 2010.

INKPEN G., *Information Technology for Travel and Tourism*, Edinburgh, Addison Wesley, 1998.

INVERSINI A., MASIERO L., "Selling rooms online: the use of social media and online travel agents", *International Journal of Contemporary Hospitality Management*, 2014, 26, 2, pp. 272-292.

KENNEDY-EDEN H., GRETZEL U., "A taxonomy of mobile applications in tourism", *E-review of Tourism Research*, 2012, 10, 2, pp. 47-50.

LAI I. K., "Traveler acceptance of an app-based mobile tour guide", *Journal of Hospitality & Tourism Research*, 2015, 39, 3, pp. 401-432.

LAMSFUS C. AND OTHERS, "Smart tourism destinations: an extended conception of smart cities focusing on human mobility", *Information and Communication Technologies in Tourism 2015: Proceedings of the International Conference in Lugano, Switzerland, February 3-6, 2015*, Springer International Publishing, 2015, pp. 363-375

LAZZERONI M., MORAZZONI M. (a cura di), *Interpretare la quarta rivoluzione industriale: la geografia in dialogo con le altre discipline*, Roma, Carocci, 2020.

LOPEZ DE AVILA A., "Smart Destinations: XXI Century Tourism", paper presented at the *ENTER2015 Conference on Information and Communication Technologies in Tourism, Lugano, Switzerland, February 4-6*, 2015.

LUPPIS M., "Turismo di lusso: unicità di una esperienza (sostenibile?)", in PECORARO SCANIO A. (Eds.), *Turismo sostenibile, Retorica e pratiche*, Roma, Aracne, 2016, pp. 89-116.

MALEK A., COSTA C., "Integrating communities into tourism planning through social innovation", *Tourism Planning & Development*, 2015, 12, 3, pp. 281-299.

MANGANO S., UGOLINI G. M., "Nuove tecnologie e smart map per un turismo urbano e una mobilità intelligente", *Bollettino della Associazione Italiana di Cartografia*, 2017, 160, pp. 8-21.

MEIJER A., BOLÍVAR M. P. R., "Governing the Smart City: A Review of the Literature on Smart Urban Governance", *International Review of Administrative Sciences*, 2015, 82, 2, pp. 1-17.

MICHOPOULOU E., BUHALIS D., "Information provision for challenging markets: The case of the accessibility requiring market in the context of tourism", *Information & management*, 2013, 50, 5, pp. 229-239.

MINISTRY OF TOURISM & ANTIQUITES, *Statistiche del turismo per l'anno 2022*.

MISTILIS N., BUHALIS D., GRETZEL U., "Future eDestination marketing: perspective of an Australian tourism stakeholder network", *Journal of Travel Research*, 2014, 53, 6, pp. 778-790.

MORAZZONI M., ZAVETTIERI G. G., "Geomapping. Cultural Enhancement Practices of the Jabel Shams and Jabel Akdhar Mountains in Oman", in KATSONI V., ŞERBAN A. C. (Eds.), *Transcending Borders in Tourism Through Innovation and Cultural Heritage*, Springer, Cham, 2022, pp. 597-614.

MORAZZONI M., ZAVETTIERI G.G., *Geografia, Nuove tecnologie e Turismo,* Roma, Carocci, 2023.

MOSSBERG, L., "A marketing approach to the tourist experience", *Scandinavian journal of hospitality and tourism*, 2007, 7, 1, pp. 59-74.

NATIONAL CENTRE FOR STATISTICS AND INFORMATION, SULTANATE OF OMAN, *Data Portal,* 2022 (https://www.ncsi.gov.om/Pages/NCSI.aspx).

NEUHOFER B. E ALTRI, "A typology of technology enhanced tourism experiences", *International journal of tourism research*, 2014, 16, 4, pp. 340-350.

NO E., KIM J.K., "Determinants of the Adoption for Travel Information on Smartphone", *International Journal of Tourism Research*, 2014, 16, 6, pp. 534-545.

NEUHOFER B. AND OTHERS, "Smart technologies for personalized experiences: a case study in the hospitality domain", *Electronic Markets*, 2015, 25, pp. 243- 254.

O'CONNOR P., *Using Computers in Hospitality*, London, Cassell, 1995.

O'CONNOR P., *Electronic information distribution in tourism and hospitality*, Wallingford, CAB, 1999.

O'CONNOR P., RAFFERTY J., "Gulliver-distributing Irish tourism electronically", *Electronic Markets*, 1997, 7, 2, pp. 40-45.

OMAN VISION 2040, *Vision Document* (https://www.2040.om/Oman2040-En.pdf).

PACCAGNELLA L., VELLAR A., *Vivere online: identità, relazioni, conoscenza,* Bologna, Il Mulino, 2016.

PAN B., FESENMAIER D. R., "Online information search: vacation planning process", *Annals of Tourism Research*, 2006, 33, 3, pp. 809-832.

PARASKEVAS A. ET AL., "Search engine marketing: Transforming search engines into hotel distribution channels", *Cornell Hospitality Quarterly*, 2011, 52, 2, pp. 200-208.

PEACOCK M., *Information Technology in Hospitality*, London, Cassell, 1995.

PIRO G. AND OTHERS, "Information centric services in smart cities", *Journal of Systems and Software*, 2014, 88, pp. 169-88.

POLLOCK N., WILLIAMS R., "The sociology of a market analysis tool: how industry analysts sort vendors and organize markets", *Information and Organization,* 2009, 19, 2, pp. 129-151.

RUDAS I. J., FODOR J., "Intelligent systems", *International Journal of Computers, Communication & Control*, 2008, III, pp. 132-138.

RYAN M.L., "Space", in HUHN P., SCHMID W., SCHONERT J. (Eds.), *Handbook of narratology*, Berlin, Water de Gruyter, 2009.

SCAFA L., "Tecnologia e innovazione applicate ai cammini e ai sentieri. Il caso dei Monti Prenestini", in LAZZERONI M., MORAZZONI M., ZAMPERLIN P. (a cura di), *Geografia e tecnologia: transizioni, trasformazioni, rappresentazioni*, 2023, 22, Società di Studi Geografici, Memorie geografiche, pp. 373-379.

SHELDON P. J., *Tourism information technology*, Wallingford, Cab International, 1997.

SHELDON, P.J., "Destination Information Systems", *Annals of Tourism Research*, 1993, 20, 4, pp. 633-649.

SIGALA M., "Gamification for crowdsourcing marketing practices: Applications and benefits in tourism"*, Advances in crowdsourcing*, 2015, pp. 129-45.

SIGALA M., CHRISTOU E., GRETZEL U. (Eds.), *Social media in travel, tourism and hospitality: Theory, practice and cases,* Ashgate Publishing, Ltd, 2012.

STICKDORN M., ZEHRER A., "Service design in tourism: Customer experience driven destination management", *First Nordic conference on service design and service innovation, Oslo*, 2009, pp. 1-16.

TURCO A., *Epimedia. Informazione e comunicazione nello spazio pandemico,* Milano, Unicopli, 2021.

TUSSYADIAH I. P. E ALTRI, "Virtual reality, presence, and attitude change: Empirical evidence from tourism"*, Tourism management*, 2018, 66, pp. 140-54.

WANG D. AND OTHERS, "The role of smartphones in mediating the tourism experience", *Journal of Travel Research,* 2012, 51, 4, pp. 371-387.

WANG D., XIANG Z. "The new landscape of travel: A comprehensive analysis of smartphone apps", in FUCHS M., RICCI F., CANTONI L. (Eds.), *Information and Communication Technologies in Tourism 2012*, Wien, Springer, 2012, pp. 308-319.

WERTHNER H., "Intelligent Systems in Travel and Tourism", *International Joint Conferences on Artificial Intelligence Organization (IJCAI)*, 2003, 3, pp. 1620-1625.

WERTHNER H. AND OTHERS, "Future research issues in IT and tourism", *Journal for Information Technology and* Tourism, 2015, 15, 1.

WEST J., GALLAGHER S., "Challenges of open innovation: the paradox of firm investment in open source software", *R&D Management,* 2006, 36, 3, pp. 319-331.

WÖBER K. W., "Information supply in tourism management by marketing decision support systems", *Tourism Management,* 2003, 24, 3, pp. 241-255.

XIANG Z., WOBER K., FESENMAIER D., "Representation of the online tourism domain in search engines", *Journal of Travel Research*, 2008, 47, 2, pp. 137-150.

XIANG Z., TUSSYADIAH I., BUHALIS D., "Smart destinations: Foundations, analytics, and applications", *Journal of Destination Marketing and Management*, 2015, 4, 3, pp. 143-144.

YOO K.-H. ET AL., "Exploring TripAdvisor", in EGGER R., GULA I., WALCHER D. (Eds.), *Open Tourism- Open Innovation, Crowdsourcing and Collaborative Consumption challenging the tourism industry*, Heidelberg, Springer Verlag, 2015.

ZAVETTIERI G.G., "App interattive per la valorizzazione turistica dell'Oman", *documenti geografici*, 2021, 2, pp. 147-163.

ZAVETTIERI G.G., MORAZZONI M., "GIS of Place, GIS of People. Mobility, Tourism and Interactivity of map (app)", in DE MARCHI M., PIOVAN S., PAPPALARDO S. E. (Eds.), *Atti del XXXIII Congresso Geografico Italiano Padova, 8-13 settembre 2021*, 2023, V, pp. 290-297.

App GIS-based per le Smart Tourist Destinations nel Governatorato di Muscat, Oman. – Le ICT e il turismo giocano ruoli fondamentali nello sviluppo delle economie globali emergenti, offrendo opportunità e strumenti strategici per promuovere la crescita delle mete. Le Destinazioni Turistiche Smart (STD) utilizzano strumenti e tecnologie disponibili per co-creare valore ed esperienze immersive per i turisti, generando nel contempo profitti e benefici per le organizzazioni e la destinazione nel suo complesso.
Il presente contributo espone nella sua totalità le fasi dello sviluppo di un'applicazione per smartphone progettata per l'esplorazione del territorio dell'Oman, comprendente le sue diverse risorse naturali e culturali, infrastrutture turistiche e strutture ricettive. La metodologia impiegata comprende la raccolta dati da fonti primarie, la georeferenziazione di numerosi punti di riferimento naturali, culturali e ricreativi, e l'utilizzo degli strumenti Arc-GIS e Google Earth per l'elaborazione dei dati. L'applicazione sviluppata si dimostra essere uno strumento intelligente e reattivo, in grado di soddisfare le esigenze del turismo esperienziale. Offre agli utenti la possibilità di personalizzare itinerari in linea con i loro gusti, preferenze ed esigenze. Integrando tecnologie all'avanguardia e dati geografici, l'applicazione per l'esplorazione dell'Oman porta le esperienze turistiche a nuove vette, mettendo in evidenza le diverse attrazioni del paese. Questo articolo specifico presenta le considerazioni finali alla luce di una serie di cambiamenti ambientali e territoriali che sono avvenuti durante la fase di validazione.

Keywords. – Geographical Data, App, Oman, Smart Tourist Destination, Sustainability, Community-oriented smart tourism initiatives

Tor Vergata University of Rome, Department of History, Cultural Heritage, Education and Society
giovanna.zavettieri@uniroma2.it

Sultan Qaboos University, Remote Sensing and GIS Research Center
yalmula@squ.edu.om