Smart Innovation, Systems and Technologies 345

João Vidal Carvalho
António Abreu
Pedro Liberato
Alejandro Peña *Editors*

Advances in Tourism, Technology and Systems

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Pedro Liberato · Alejandro Peña
Editors

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Editors
João Vidal Carvalho
Porto Accounting and Business School
Institute of Accounting and Administration
of Porto (ISCAP)
Polytechnic Institute of Porto
São Mamede de Infesta, Portugal

Pedro Liberato
School of Hospitality and Tourism
Polytechnic Institute of Porto
Vila do Conde, Portugal

António Abreu
Institute of Accounting and Administration
of Porto (ISCAP)
Polytechnic Institute of Porto
São Mamede de Infesta, Portugal

Alejandro Peña
Department of Accounting, School
of Management
EAFIT University
Medellin, Colombia

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Preface

This book—*Advances in Tourism, Technology and Systems: Selected Papers from ICOTTS 2022, Volume 1*—from the SIST Series is composed of the best selected papers accepted for presentation and discussion at the 2022 International Conference on Tourism, Technology and Systems (ICOTTS'22). The ICOTTS is a multidisciplinary conference with a special focus on new technologies and systems in the tourism sector and was held between 03 and 05 November 2022. The ICOTTS'22 was supported by the Autonomous University of Chile, Santiago, Chile and by International Association for Digital Transformation and Technological Innovation (IADITI).

The International Conference on Tourism, Technologies and Systems is an international forum for researchers and professionals in the tourism sector, which enables the discussion of the latest innovations, trends and concerns in several areas, in the Tourism sector, associated with Information Technologies and Systems. It is an event for professionals in the sector, in search of technology solutions, where academics, IT experts and business managers meet to discuss new ideas that help them maximize the potential of tourism business through technology.

The ICOTTS'22 Scientific Committee is composed of a multidisciplinary group of 137 experts who assessed some 296 papers from 22 countries, received for each of the main topics proposed for the conference: (a) Tourism research in providing innovative solutions to social problems; (b) Information and communication technologies in hospitality and tourism industry; (c) Sustainable tourism; (d) Tourism trends; (e) Health and wellness tourism; (f) Tourism management; (g) Marketing strategies in hospitality and tourism industry; (h) Hospitality, tourism and foodservice environment; (i) Tourism in the different scientific areas; (j) eTourism and Tourism 2.0.

The papers accepted for presentation and discussion at the conference are published by Springer and will be submitted for indexing by ISI, SCOPUS, Ei Compendex, Google Scholar and SpringerLink.

We thank all those who contributed to the ICOTTS'22 conference (authors, committees, workshop organizers and sponsors). We deeply appreciate your involvement and support, which were crucial to the success of the conference.

Porto, Portugal
November 2022

João Vidal Carvalho
cajvidal@iscap.ipp.pt

António Abreu
aabreu@iscap.ipp.pt

Pedro Liberato
pedrolib@esht.ipp.pt

Alejandro Peña

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Interactive Virtual Tours: A Contribution to Promoting Tourism

Vitor Gonçalves and Juliana Costa

Abstract Tourism plays a crucial role in the world economy, and in this sense, digital technologies have been an asset to promote the sector. Digital technologies have revolutionized society and in recent years have become even more accessible to the end-user. With the growth of the web, the end-user went from being a mere passive spectator to an active agent in the construction and communication of information, allowing the creation of value through the publication of content on social networks to stimulate the regions. This study, through an innovation idea awarded in the year 2021, makes use of the Design Science Research methodology to propose the construction of an artifact aimed at boosting tourism in the interior regions of Portugal and thus co-create a tourism ecosystem capable of interconnecting the various actors involved in the promotion of services. For the construction of the innovation idea, a narrative research was carried out, to be explored within the scope of this methodology. As a result, we present an innovative idea that proposes the construction of a web portal to be explored through the offer of virtual routes. The web portal, through local guides, will be able to offer the creation of a link between the tourist and the desired travel destination. In the future, the web portal will also be able to offer services in the field of education, such as virtual study tours.

Keywords Digital technologies · Smart tourism · Design science research

V. Gonçalves (✉)
CIEB, Instituto Politécnico de Bragança, Bragança, Portugal
e-mail: vg@ipb.pt

J. Costa
Instituto Politécnico de Bragança, Bragança, Portugal
e-mail: julianacosta@ipb.pt

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1 Introduction

The tourism sector is one of the economic activities that contributes most to the world economy, acting in countries as a promoter of employment, conservation of heritage and promotion of sustainable development. In Portugal, in 2021, it represented 8% of the Gross Domestic Product (GDP), an important contribution to the recovery of the country's economy, given the constraints suffered by the SARS-COV-2 pandemic [1]. According to the Agency for Investment and Foreign Trade of Portugal [Agência para o Investimento e Comércio Externo de Portugal (AICEP)], in 2019, for every five euros spent in the country, one came from tourism, thus representing a great opportunity to promote the sustainable development of the regions [2].

Over the years, tourism has undergone huge transformations, much in function of the advancement of digital technologies that connect the tourist with the desired services and destinations [3], providing the development of tourism ecosystems focused on the promotion of the territory and the creation of local and regional value [4]. Also, according to Pencarelli's definition [4], tourism ecosystems are constituted by all the actors involved in the creation of a valuable experience within the sector, being able to make use of information and communication systems to create digital environments, which promote a tourism more connected with the end-user's necessities and in a sustainable way.

According to Choi et al. [5], digital technologies have been an agent of transformation in tourism experiences, through the development of multimedia artifacts using Virtual Reality, Augmented Reality and dedicated websites, videos on Youtube.com, videoconferences, among others. Still for Foris et al. [6], after the advent of the SARS-COV-2 pandemic, digital technologies became even more essential for the development of the sector, thus assuming a fundamental role in the dynamization of the regions.

Choi et al. [5] state that the creation of digital technologies for tourism must take into consideration several factors in order to meet the desired purposes, proportioning an enjoyable experience to the end-user so that bonds are created with the desired destination.

The creation of artifacts within digital technologies is inserted in the Information Science, which is concerned with ensuring the rules of usability and navigability, in order to design a product capable of adding positive value to the end-user [7]. Within Information Science, the methodology of Design Science Research (DSR) focuses on the development of real practical solutions to a problem, considering the careful development of scientific research within the parameters necessary for the creation of the artifact [8].

In this sense, this work will make use of DSR to propose a digital artifact for tourism, based on an innovation idea awarded in 2021, within a contest promoted by La Caixa Foundation (Fundación La Caixa), Portuguese Investment Bank (Banco Português de Investimento (BPI)) and Fundação para a Ciência e Tecnologia (FCT) [9]., (BPI) e Fundação para a Ciência e Tecnologia (FCT).

The objective of the work consists in presenting the necessary phases for the development of an idea within an innovation and co-creation process, through the DSR. In this scope, it was chosen to use narrative research, more adequate to the work methodology of the study. For the research, several sources were consulted, including the main bibliometric databases, as well as other searches on the World Wide Web.

From the above, this article includes a brief introduction, the state of the art on tourism and digital technologies, the methodology based on the DSR, the characterization and presentation of an innovation idea and the final considerations.

2 Tourism and Digital Technologies

Digital technology has long been used within the tourism sector, contributing to the development and competitiveness of corporations [3]. Since the 60s of the last century, it has been present in the management systems of companies, working namely through computer reservation systems (CRS) in the areas of airline reservation management, hotels, agencies and tour operators and destinations [6].

Since the 90s, with the easy access to the internet, portable equipment and more user-friendly software, society has entered the Web 1.0 era. The tourism sector quickly modernized to take advantage of information and communication technologies (ICTs), namely with the development of dedicated websites and the practice of digital commerce [3]. With the development of new ICT artifacts, such as social networks, blogs, among others, the era of Web 2.0 began, where the end-user started to play an active role in the construction of information and communication, having an important impact on tourism as Anaya and Lehto [10] and Buhalis [3] state.

Since the beginning of this century, there has been a transition to Web 3.0, also known as Semantic Web, whose main goal is the integration, inter-exchange and semantic understanding of information, both from the human and the machine viewpoints, through the transformation of the current web (readable only by humans) into a semantic information web (readable by both humans and machines) that has the particularity to describe, interrelate and understand the contents through metadata, ontologies and software agents. Meanwhile, in the beginning of the second decade of this century, with the popularization of internet access, a greater use of smarthphone's and in the reduction of the costs of creating more interactive digital artifacts, such as Virtual Reality products, Augmented Reality, videoconferences, among others [11], the evolution of web technologies and the reduction of their costs facilitated the appearance of digital environments that evolve with the interaction with the user, constituting a great opportunity for the production of digital artifacts destined, for example, to tourism, namely in the scope of museums, natural parks, science centers, spaces that besides tourism perform functions within non-formal education [4, 8, 11].

Technologies have evolved to the point where we are living a new era, Web 4.0. The era of the Internet of Things (IoT), Artificial Intelligence (AI), Meta-verse universes, blockchains, all at the distance of an access from the palm of the hand of the end-user [4].

In Pencarelli's view [4], it can be defined that in Web 1.0 the role of the end-user was a passive observer, whereas in Web 2.0 the end-user became an active agent, with interactivity as the highlight. Web 3.0, although not a universal concept, can be defined as the intelligence acquired by the web becoming more open and more connected, while Web 4.0 is seen as a web that makes use of the concept of intelligence and interactivity, being able to create virtual environments more connected to the real world.

In this sense, digital technology environments have become smart, that is, capable of producing an ecosystem of intelligent technology that creates, manages and offers services and experiences, all within a perspective of sustainability [12]. In tourism, smart tourism translates into the development of a sustainable ecosystem, based on digital technologies, through the various actors involved in tourism development [4, 6].

From the reflection made on the evolution of digital technologies, it is noteworthy that in the public health advent of the SARS-COV-2 pandemic, the resolution of problems went mostly through the use of digital technologies, further boosting the innovation and co-creation of artifacts for the promotion of tourism [6].

Virtual videoconferencing environments gained prominence, providing virtual and collaborative work using platforms such as Zoom, Teams and others [11]. The use of this artifact gave rise to new business opportunities, such as the Virtual Tourism Portal [13], in Brazil, and the virtual study tours offered by NewsMusuem@ Zoom [14], in Portugal.

In conclusion of this brief review, digital technologies contribute to the development of tourism through intelligent and interactive artifacts that help tourists build a travel experience that leads to well-being and a positive image of the visited destination [5]. End-user interactivity with digital technologies has become influential factors in selling destinations, leading to a greater need to create an efficient tourism ecosystem capable of meeting tourist expectations in both real and virtual environments [4, 5].

3 Methodology Based on Design Science Research

Within Information Science, the DSR methodology can be considered an added value for the proposition of digital artifacts developed within the scope of innovation and co-creation [7, 8]. Thus, it seemed to us that DSR would be the most appropriate methodology for this work, since it sought to develop an artifact for tourism within a competition for an innovation idea, in the year 2020, focused on promoting solutions to the constraints caused by the SARS-COV- 2 pandemic.

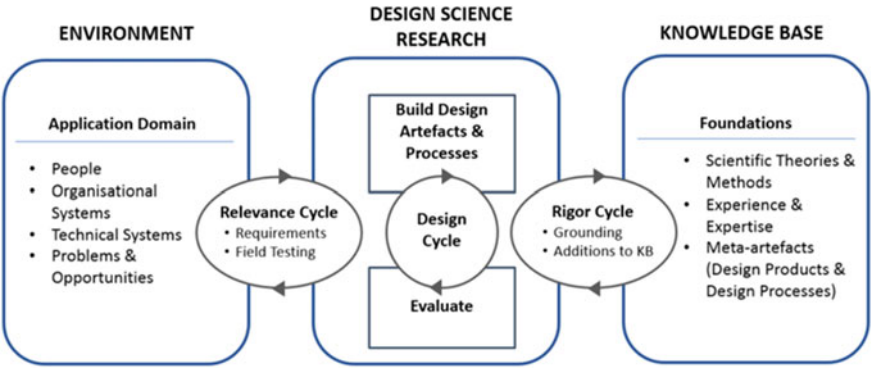

Fig. 1 Hevner's Design Science Research Cycles. *Source* Hevner, A. & Chatterjee, S., Design Research in Information Systems—Theory and Practise. Springer (2010)

Pádua [8, p. 6] highlights the concept of design defined by the World Design Organization (WDO), as "a strategic problem-solving process that drives innovation, establishes business success, and provides an improvement in quality of life through the creation of and solutions in products, systems, and innovative experiences". Pádua [8, p. 6] complements that DSR "connects innovation, technology, research, business and customers to provide new values and competitive advantages in economic, social and environmental spheres", meeting the desired goals of tourism ecosystems [4].

For Rodrigues [7], the DSR develops solutions to real problems based on scientific research, being useful for the Social Sciences.

For the development of this study within the scope of this method (see Fig. 1), it should be noted that narrative research was also used, due to the need to understand the scientific literature and the artifacts used in the tourism context.

For the literature review, the bibliometric databases Scopus and Web of Science (WOS), the Open Access Scientific Repositories of Portugal (RCAAP), Google Scholar, as well as the World Wide Web, namely governmental portals and websites related to the theme of the project, were consulted.

4 Characterization and Presentation of an Innovation Idea

The La Caixa Foundation and Banco BPI, since 2018, open calls for innovation ideas contest in Portugal, under the Promote Program, to support initiatives that contribute to the enhancement of inland territories, with the development of frontier dynamics that are replicable to other regions of the country. Since the year 2020, the Foundation for Science and Technology (FCT), joined this program contributing to strengthen the R&D ecosystems, and through the contest "Promote the future of the interior", encourages the participation of higher education institutions to co-create innovation ideas for problem solutions [15].

The contest was defined in two distinct phases, the submission via platform of a project of innovation idea, which was evaluated by a committee formed by the promoting entities, and after the definition of the best ideas, they were invited to submit a feasibility plan, for the validation of results and respective award. The contest bases determine a maximum of nine awarded ideas, being three per region, namely Center, South and North [16].

We now present the definition of the innovation idea awarded in the year 2021 [9], Trás-os-Montes Interactive: Virtual Paths. The idea projects the development of a web portal to allow virtual tourism experiences, as a way to disseminate the most attractive places, in a first phase of the Trás-os-Montes region and, later, of other regions of the country and even the world. Through multimedia resources, there will be guided tours by videoconference to enable the tourist to see the points of interest of the desired destination. Given the rules of usability and accessibility, it is also intended to offer virtual guided tours in Portuguese sign language.

The idea proposes the construction of a web portal for the realization of virtual routes within the nine transmontane counties, through the use of videoconferencing platforms and the use of human resources, namely through local guides and corresponding multimedia technological resources such as photos, videos, audios, Google Earth, among others. The goal of the portal is to propitiate the construction of a tourism ecosystem in the Lands of Trás-os-Montes, thus creating job opportunities in the interior and dynamizing the local economy.

The first phase of the contest focused on the development of a project of an innovation idea, which should present a summary description of the idea within the three thematic areas defined by the contest bases [16]: (i) prevention of natural hazards, strengthening the capacity to adapt to climate change and efficient management of resources, particularly in cross-border ecosystems; (ii) creation or co-location of new poles of specialization that contribute to attracting qualified human resources and business investment-oriented toward external markets around business projects focused on insertion in international value chains through customer and supplier networks and (iii) enhancement of symbolic capital and the capacity for international recognition with regard to the environmental, landscape and heritage value of the territories, contributing to the attraction of tourists and new residents. This innovation idea is inserted in the third thematic area and hopes to contribute to the territory's valorization, creating opportunities for the settlement of residents and the creation of a sustainable tourist ecosystem, with a view to the territory's inter-nationalization.

Also according to the contest's bases [16], the project presented the following structure: (i) general presentation of the idea, with emphasis on the motivation and diagnosis; (ii) detailed description of the idea, identifying a potential plan with the project phases and an action schedule; (iii) general and specific objectives and the potential for the concretization of the project; (iv) resources and impacts, where team members and their contributions to the feasibility of the project should be presented, as well as possible partners in the development of the idea and the positive impacts proposed by the implementation of the idea; (v) potential economic and social impact, i.e., how the idea can generate value within the territory and how it can be replicated to other regions in new contexts.

In this sense, in the application submission stage, contacts were made with the nine Municipalities of the Lands of Trás-os-Montes (Alfândega da Fé, Bragança, Macedo de Cavaleiros, Miranda do Douro, Mirandela, Mogadouro, Vila Flor, Vimioso and Vinhais) and with the main actors for the development of the idea identified in the research: (i) Polytechnic Institute of Bragança (IPB); (ii) School of Communication, Administration and Tourism (EsACT); (iii) Intermunicipal Community of the Lands of Trás-osMontes (CIM-TTM); (iv) MORE Mountains of Research Collaborative Laboratory—Association; (v) Municipal associations of territorial development of Trás-os-Montes (CoraNE, NERBA); (vi) Public and/or private tourism outreach agencies.

For all the above-mentioned entities, a document was sent containing a brief explanation about the purposes of the idea, and later, it was requested the expression of interest in developing the idea within an I&D project, namely through a Letter of Support. In this sense, the team obtained nine letters of support from various entities that expressed interest in transforming the idea into an I&D project to boost tourism. The stages of the project were also scheduled using a Gantt diagram (see Fig. 2).

After the results of the selection of the nine best ideas nationwide, the contest's foundations define that the teams have 90 days to submit the viability plan for the proposed innovation idea. In the feasibility plan, the feasibility of the project is presented by prospecting factors such as economic resources, human resources, technological resources and material resources. The plan should also present a prospection of the advantages of the idea within the degree of innovation in the territory.

The Project Viability Plan determines the following structure for the validation of the idea: (i) detailed presentation of the idea; (ii) plan for implementing the idea in a project, with a budget estimate; (iii) degree of innovation; (iv) impact of the project, with the presentation of indicators of the actions to be developed, results and

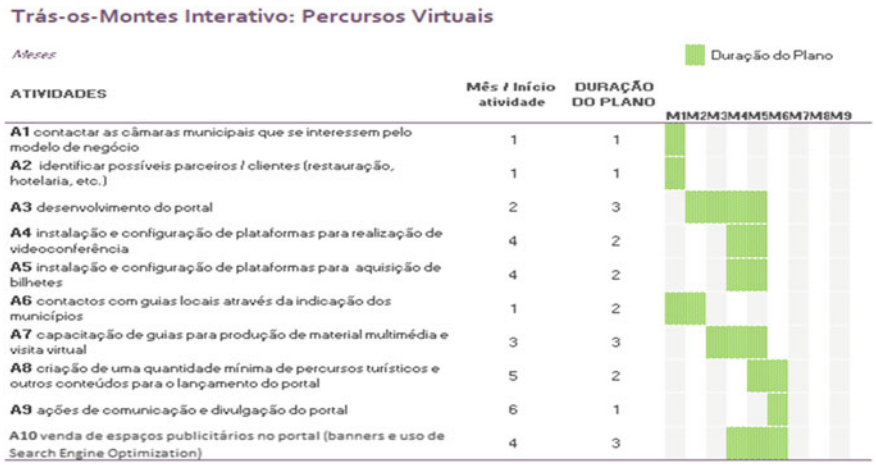

Fig. 2 Gantt chart of the project. *Source* Authors, 2021

expected goals and the effects of the dissemination of the results in the territory, as well as the ability to be replicated to other regions.

As resources necessary for the development of the portal, the following items were considered: installation and construction of the portal (open-source resources); acquisition of a domain, web server hosting and internet access package; access to platforms that allow the management of ticket purchases; platforms for videoconferences (Zoom, Teams, etc.); web portal maintenance; computer, computer, computer equipment, etc.); web portal maintenance; computer and accessories (headphones, webcam, tablet, etc.); digital tourist guides of the partner municipalities; audiovisual multimedia material (photos, videos, and other possible resources); training material for the production of audiovisual multimedia material; training material for virtual communication; and a communication plan for the portal.

For financial viability, the main values were estimated for a 3-year period, taking 2021 as the reference year: domain and hosting: 5400 euros [17]; telecommunication and internet services: 1439.64 euros; transportation: 3.240 (average of 250 km/month) [18]; Zoom videoconferencing platform: 539.64 euros [19]; ticket management platform (open source); human resources: 122,400 euros (3 people); multimedia resources: 1000 euros; (bench)marketing actions for dissemination of the web portal: 18,000 euros. It is therefore considered that the value of the financial execution plan for the three years will be approximately 152,019.28 €.

Also, within the viability plan for the development of the web portal, the need for professionals from three scientific areas, technology, tourism and environment, was considered. As fundamental human resources for the success of the portal, the local guides would be trained to develop multimedia content, to be autonomous in managing the customization of the product, and to use the virtual environment as a new way to guide the route. We are also aware that the portal must follow the rules of usability and navigability, and within the parameters of social inclusion, not forgetting the training of guides to provide services in Portuguese sign language, in order to promote the inclusion of the deaf community.

More recently, it was understood that the portal can be a valuable resource to be used in education, through the use of the portal for conducting virtual study tours, which will allow greater access to the territory, since the virtual study tours (VEV) demand lower costs, are less bureaucratic and can be performed within the class period of the teacher [20]. VEVs contribute to a better understanding of theoretical contents allied to practice by the students, as well as to a greater interaction of the students with the culture and tradition of the territories, connecting knowledge and know-how. VEVs are an advantage for learning taking into account the student profile at the end of compulsory schooling [21].

The artifact developed through the use of the DSR, namely the web portal Trás-os-Montes Interactive: Virtual Tours, intends to provide the tourist a unique environment to know the territory, contributing to the purchase decision processes of destinations. In this sense, the portal will be a gateway to the territory by offering virtual routes in the municipalities and, in the near future, may evolve to offer other national and even international routes.

4.1 Interactive Trás-os-Montes: Virtual Routes' Mockup

For a better visualization of the innovation idea, a mockup was developed in the Wireframe Pro tool, with the main features to be offered in the web portal for the realization of virtual paths.

Figure 3 represents the portal's homepage, where it offers the available routes, including the identification of routes to be taken using Portuguese sign language. It also provides a chat space through the use of artificial intelligence (Chatbots, which are nothing more than software that talks to a person, meeting their main needs quickly and assertively) for a first assistance.

Figure 4 refers to a more detailed description of a route and includes the identification of the responsible guide and a direct chat space with the guide, where the tourist can ask questions before purchasing the desired virtual route.

Figure 5 refers to the ticket purchase management that will be performed through open-source platforms that perform this sale, taking into account the security of the financial operation.

Figure 6 demonstrates the realization of a virtual tour through the use of video-conference and other multimedia resources. The interaction with the local guide will be the key factor for the successful promotion of the virtual tours offered.

The mockup represents only an initial idea of the web portal to be developed within the rules of usability and navigability and will be improved as the project develops.

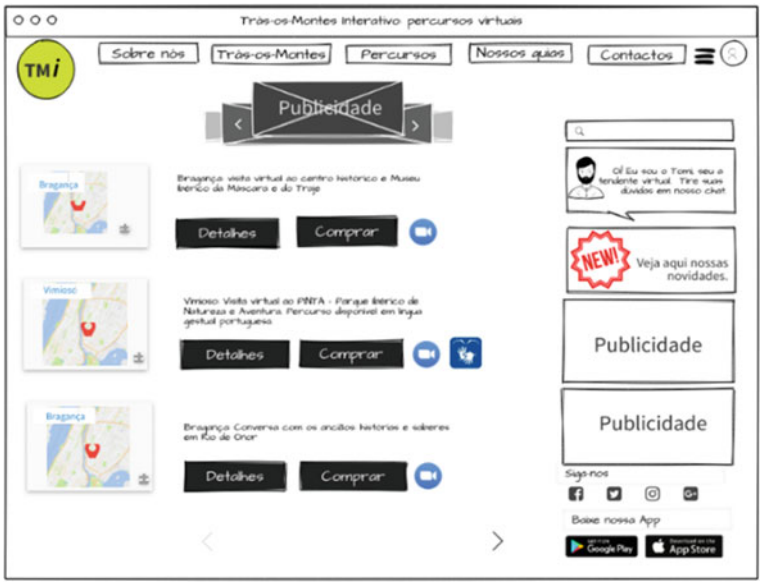

Fig. 3 Mockup demonstrating the website homepage. *Source* Authors, 2021

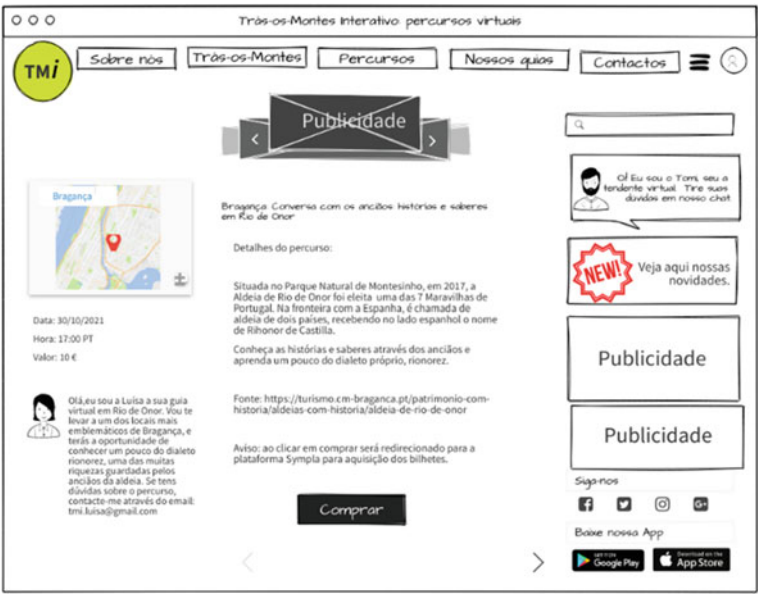

Fig. 4 Mockup demonstrating the details of a virtual course. *Source* Authors, 2021

Fig. 5 Mockup demonstrating ticket purchasing management. *Source* Authors, 2021

Fig. 6 Mockup demonstrating the virtual environment via Zoom video conferencing. *Source* Authors, 2021

5 Final Considerations

Tourism directly influences various sectors of the economy worldwide, contributing to the sustainable development of regions, by promoting opportunities for employment and income generation. In Portugal, in the year 2021, tourism contributed considerably to the national GDP, being considered one of the sectors with strong added value for the development of inland regions, especially after the constraints caused by the SARS-COV-2 pandemic.

The creation of sustainable tourism ecosystems depends mainly on the evolution of digital technologies, capable of interconnecting the various players that operate within the sector.

The various phases experienced by the evolution of the web have transformed the end-user into an active agent of information and communication, and for tourism, the same has taken on an influential role in the process of publicizing regions, especially inland regions.

In tourism, digital technologies have been popularizing the use of virtual environments to contribute positively to the creation of new services that allow tourists a greater connection with destinations and a better decision to purchase the desired destination.

In this context, virtual tours available through videoconferences can be an asset for the promotion of territories, since they allow tourists to visit a locality through multimedia resources and have direct contact with local guides, who will be prepared

to provide information and clarify questions about the locality, thus creating a positive link between the tourist and the desired destination, to later be able to better decide the destination to visit physically.

In short, the DSR methodology facilitated thinking creatively about a web portal dedicated to the service of virtual routes, acting through the customization of the destinations to be explored, seeking to meet the needs of the users of the service. It should be noted that, in the near future, after its implementation, the portal also intends to be an agent of non-formal education, acting in the field of scientific tourism and in primary and secondary education through virtual study tours.

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