

Facultad de Economía, Empresa y Turismo

**APLICACIONES DE LA DIGITALIZACIÓN
Y LA REALIDAD EXTENDIDA EN EL
ENTORNO TURÍSTICO DE LAS ISLAS
CANARIAS**

**DIGITALIZATION AND EXTENDED REALITY
APPLICATIONS IN THE CANARY ISLANDS
TOURISM ENVIRONMENT**

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Abstract

Over the last two decades, digitalization has become a fundamental phenomenon in our daily lives, as it allows society to perform several tasks with improved efficiency and quality. Although its use is widely spread in many contexts, the truth is some of its applications, especially those in relation to extended reality, have not been completely implemented in the tourism industry. This research work aims to analyze how the Canary Islands could perform a sensible application of these digital features in the tourism offer of the archipelago. For that purpose, a compilation of places, products, and services will be examined in order to detect potential digital enhancements for them. While most qualitative information collected for this project has been gathered mostly from academic research and documents online, official web sites and audiovisual material were considered as well. On the other hand, some quantitative data was extracted from statistic organizations and surveys carried out by official institutions. In conclusion, my main intention is to prove that digitalization in the Canary Islands' tourism environment presents several advantages in many contexts.

Keywords: Digitalization, Extended Reality, Implementations, Tourism

1. Introduction

If one thing is clearly observable, is that recently generated business as well as those who have been in the market for years find themselves in an environment that is turning even more digitalized over time. The process goes through different types of means, such as Internet, Intranet, Blockchain or an imminent new space denominated the metaverse. This virtual place allows the user to experiment reality through a wide range of possibilities that are not available in the genuine and physical environment. Consequently, it is easy to understand that every single touristic destination or firm that takes advantage of this opportunity will be able to differentiate themselves from their competitors, at the same time they become referents in this sector. Undoubtedly, the Canary Islands have been consolidated as an internationally known place along the past years, and because of being a mature destination, this could be the best chance to evolve towards a more prosperous future. In other words, it would avoid the slope stage that many suffer because of a lack of adaptability to changes in the environment, eventually becoming obsolete.

In fact, although this scenario is still in development, the metaverse is beginning to pop up in the Islands. Experts claim that currently there are barely any projects aimed to the virtual world in the Canaries yet. However, the territory could be prone to future innovations. Proof of that can be found in the various iconic landmarks already being bought as virtual properties, where the owner has the possibility to generate any kind of asset and sell services related to them.

2. Objectives

- To prove that latest technologies in relation to digitalization processes and expanded reality will suppose significant changes in how people buy, experiment, and perceive products and services.
- To understand that said technologies have true potential to become an essential component of the many interactions carried out in the tourism environment.
- To introduce practical applications for these incoming technologies among the various activities that attract tourist attention in the Canary Islands.

3. Methodology: A Qualitative Approach

The most suitable and main procedure for this investigation would be the development of a well-structured qualitative research due to the nature and characteristics related to the topic, although quantitative data from certain sources will also be considered. We are analyzing how society experiment a brand new social phenomenon that is affecting people in many environments. Since this area of study is still recent, a thorough research would be necessary in other to acquire as much information as possible from different sources.

First, literature review will be the most used approach in this investigation. Its purpose is to gather a certain number of academic documents for their further

analysis. In that sense, relevant information will be extracted from these sources, mainly being books, articles, or academic magazines to ultimately reach congruent conclusions about how both the tourism environment and technological advances could synergize with each other to improve quality in different contexts.

On the other hand, currently there are plenty of podcast, debates, conversations, talks and many other forms of discussion going on in relation to digitalization advancements and, most specifically, extended reality. These are held by specialist in understanding the evolution of latest technologies in order to divulgate and spread knowledge about them among users. Most of them picture how the metaverse can be a positive application in numerous. So, this part of the investigation consists in looking for some statements, facts, or predictions to be able to create our own conclusions, right after undergoing a careful analysis.

Eventually, in order to effectively perform my analysis, I will gather a compilation of tourism-related environments, products, and services across the territory of the Canary Islands through online research to identify those whose current situation can be improved by a technological evolution. After that, I will address many practical cases in which the integration of technological processes, especially extended reality applications, have true potential for expanding and enhancing the Canary Islands tourism offer in terms of increasing the value perceived by tourists, improving tourism products for a better experience, or diminishing sustainability vulnerabilities.

4. Literature Review

4.1. Current Context of Tourism in the Canary Islands

The Canary Islands are one of the most consolidated destinations worldwide. Within Spain, it has been the second most visited region. Its evolution on tourist arrivals over the years has presented an overall increasing tendency, reaching up to 15,11 million tourists in 2019. Then, due to the 2020 pandemic, the whole tourism industry hit bottom, as restrictions imposed to avoid major health risks provoked a sudden interruption in the flow of tourists between places (Statista, 2022) (Annex A). Nevertheless, values have grown these last few years and perspectives are quite positive, as in July 2022 tourist arrivals matched those from years before the pandemic. In that regard, international tourist arrivals in such moment were almost 1.1 million, just as many as in July 2019, which amounted to quite similar figures. As it is appreciable, the data obtained from July 2022 indicate a solid recovery from the effects caused by the pandemic, especially if we check arrivals in 2020 and in 2021, which were considerably inferior, 215 thousand and 414 thousand respectively (Turespaña, 2022) (Annex B). Furthermore, according to statistics provided by the INE we can assert the importance of the Canary Islands as a pioneer region for international tourism arrivals within the Spanish territory. After reaching the number of 13,1 million international tourists in 2019, the Canary Islands ranked third among the other

regions, almost tied with the Balearic Islands in second place, since it presented similar data, and Catalunya leading first with 19,3 million (INE, 2022) (Annex C).

With all this data taken into consideration, it is possible to affirm that, before the pandemic, the Canary Islands has presented great potential for attracting tourists over the years so far. In that sense, according to survey statistics from the ISTAC displayed by Promotur on which factors remain the most relevant for visiting the Canary Islands, it was shown that the climate conditions, safety environment, sea proximity, overall tranquility, and unique landscapes, among many other attributes, represent key factors for incentivizing tourists into choosing this destination for their holidays (Annex D). Moreover, the various aspects asked in such surveys from this report allow to understand which is exactly the profile of tourist that come to the Canaries. Therefore, the most typical profile would be travelers from the United Kingdom within the age range of 31 to 45, usually accompanied by their partners, with an annual household income between €25.000 and €50.000 (ISTAC, 2021). On the other hand, even after a devastating crisis, it has proven its capabilities for returning to pre-pandemic figures in a relatively short period of time. Nevertheless, although figures may continue to increase over the years, it is necessary to look forward and assess new tendencies in the market for relaunching a transformed offer that caters to a new tourism environment.

Regarding current proposals aimed to improve tourism quality in the islands, there is currently one strategy that points towards a transformation for the tourism model in the Canaries, which has been elaborated by “Turismo de Islas Canarias” in 2021, a public entity dedicated to the management of the tourism brand attached to the Canary Islands. As they inform in their strategic plan (Promotur Turismo de Canarias, 2021), after the stabilization of the pandemic situation, a new tourism stage is happening worldwide at the moment, for which the Canary Islands must keep maintaining their competitiveness. Among the reasons addressed in the plan for such need of evolution, I would highlight the several changes in the worldwide tourism model currently taking place, and digitalization remained as the main factor for explaining those changes, along with the appearance of new market niches. Furthermore, it was observed that customers are now searching for more authentic experiences at the same time they show an increasing concern about the environment. Considering all the forementioned aspects of this new scenario, “improvement of resilience, sustainability efforts and value creation for the economy” are the three main objectives proposed by Promotur to follow the strategy, which are set to be accomplished through several strategic actions, of which I would highlight “leadership in digitalization, knowledge management, innovation and creativity, continuous formation and proper cooperation between public and private institutions” (Promotur Turismo de Canarias, 2021) as the most relevant for the purpose of my analysis.

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4.2. Digitalization in Tourism

Among the various innovations that are being implemented in tourism, digitalization is one of the most recent ones. There are many ways of defining this concept, but it is convenient to indicate a slight distinction between this word and other with similar connotations. Digitization can be addressed as “the material process of converting analog streams of information into digital bits”. For its part digitalization is “the way many domains of social life are restructured around digital communication and media infrastructures” (Brennen, 2016). In other words, digitalization revolves around the idea of how certain firms or territories may be subjected to a process of reconversion to adapt towards digital evolution.

In tourism, there have been various factors that allowed a digital transformation in this sector, such as “the relationship between access to information regarding tourism services, the impact of information technologies, and their online sale-purchase process” (Saseanu, 2020). Thanks to this digital evolution, the methods of selling tourism have been deeply expanded and enhanced, as “many processes in tourism companies have become more effective, and thus more cost-efficient”. Consequently, the number of sales in the industry grows exponentially over time, since the Internet facilitates a quicker, cheaper, and more optimized distribution and transition of information, “regardless of geographical and time limitations” (Filipiak, 2020). However, the implications of digitalization are not just limited to the economic part of tourism. It also works as an effective tool to improve the evolution of sustainability in tourism in many ways. Thus, digitalization “can help us obtain statistical data from multiple tourism-related fields, improve strategies, and make wiser choices when planning our travels” (Saseanu, 2020).

4.3. The Virtual Environment in Tourism

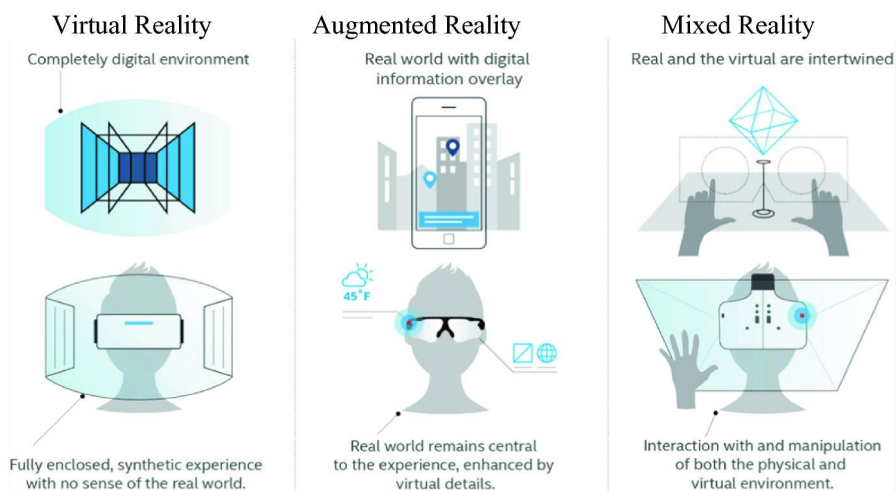
As mentioned before, the digital transformation carries with itself numerous advancements in tourism related activities and processes, but it is necessary to acquire proper infrastructure and hardware in order to set the foundations for a technological adaptability. In the following lines, I will define the virtual space in which users can interact with, the metaverse, as well as the most relevant digital platforms to access it.

4.3.1. The Metaverse

There are multiple ways of defining what the metaverse could represent in general terms. To initiate our first approach, we can say that “It aims to create a shared virtual space that connects all virtual worlds via the Internet, where users, represented as digital avatars, can communicate and collaborate as if they are in the physical world.” With both words, “meta”, meaning something that transcends, and “universe” mixed together, it implies a brand new version of the classic Internet that could be called next generation (Cheng, 2022).

A key feature of this immersive experience is customization, since every user has the possibility of creating artworks, avatars, constructions and any kind

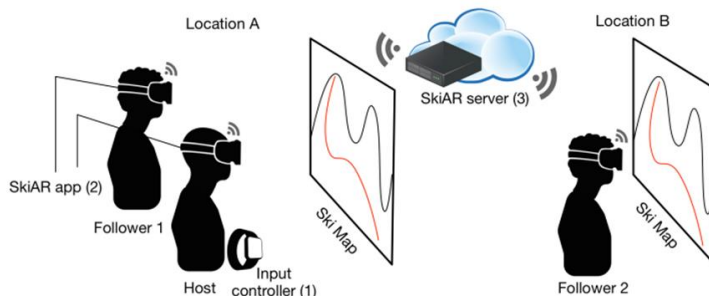
of virtual asset in the form of NFTs (not-fungible-tokens) in a decentralized blockchain (Cheng, 2022). This means items can be traded freely in this space, then using them for any kind of activity, event or service that could be profitable or of special interest. This depicted scenario encompasses a whole world of possibilities that decades ago were inconsiderable for their complexity and lack of crucial technologies. However, thanks to the advancements made in this area, like development of “5G and mobile immersive computing”, we begin to possess key tools and infrastructure to keep expanding and enhancing this alternative universe. “We have now entered an open development phase of the Metaverse, which is widely considered as a collection of 3D virtual worlds connected via the Internet and enabled by various immersive technologies such as augmented reality (AR), virtual reality (VR), and mixed reality (MR), which are often collectively referred to as extended reality (XR)” (Cheng et al., 2022).



Distinctions among VR, AR and MR. Source: appliedart.com

However, there are important differences among these three digital platforms, each one of them contributing to achieve different experiences and generate particular digital environments. In relation to VR, “users get a completely immersive digital space, and they don’t have the ability to see the real world when using VR sets” and those using AR “have digital features added to their actual experience of the real world” (Buhalis D. K., 2022). Although both of them are capable of enabling various extended reality functions, there are differences in which type of devices are required for interacting with either virtual or augmented reality. Regarding VR, the user can exclusively watch and interact with the contents shown on a screen. Videogames are one of the most extended forms of virtual reality experiences, such as Half-Life: Alyx. The content provided by the forementioned game was employed in a study, which revealed that higher screen resolutions such as 2K, 3K or 4K “have a significantly better game experience and significantly fewer SS (simulator sickness) symptoms than 1K at a refresh

rate of 72Hz” (Wang, 2022). For its part, AR devices allow users to have a full field of vision of the physical elements they are interacting with, in which digital additions are displayed for an enhanced use. For instance, SkiAR is a “wearable augmented reality system” that allows skiing or snowboard enthusiasts to share and display valuable information with other partners in a printed map, such as hazards, previous routes taken or pictures (Fedosov, 2016).



SkiAR system configuration. Source (Fedosov, 2016)

Regarding, MR “refers to the incorporation of virtual computer graphics objects into a real three dimensional scene, or alternatively the inclusion of real world elements into a virtual environment” (Pan, 2006).

4.3.2. Engagement of Users in the Metaverse

According to a report carried out by McKinsey & Company consulting group, which includes a survey addressed to more than 3.400 consumers, executives, and worldwide experts, the metaverse is depicted as the greatest opportunity of growth to various industries in the next decade, given its potential to enable new business models, products and services and to act as a mean of participation (McKinsey & Company, 2022).

In that regard, these kinds of digitalized experiences are designed to be enjoyed by people from all ages. It is expected that “more than 84% of consumers around the world would be interested in using VR or Augmented Reality (AR) for travel experiences, and 42% believe that VR and AR are the future of tourism” (Han, 2018). However, youngsters are the niche that most likely will gladly and effectively interact with this digitalized environment. “Gen Z are “digital natives” as they were born in a period when technological developments were progressing rapidly, due to the internet expansion. Gen Z is the first social group to have grown up with connectivity to the Internet and handheld electronic devices from an early age” (Buhalis D. K., 2022). They are also becoming more interested in transformational experiences, as “Virtual Reality (VR) enables them to have more engaged and diverse encounters” (Buhalis D. H., 2019). On the other hand, it would be interesting too to address the elderly as an interesting opportunity of participation in the metaverse. As it is common, this niche presents several limitations in mobility due to their advance age, which might suppose a low desire

to engage in traditional tourism leisure activities, or to travel at all. In that sense, a study carried out on how the elderly would interact with extended reality experiences (Jeng, 2017) showed that virtual reality leisure activities are presented as an alternative for elders to enjoy, providing various benefits in terms of mental and physical health. According to the article, in order for them to create a proper bond with these virtual activities, it is important to assist them through the whole process of getting used to how everything functions, as it would improve the quality of experience they perceive.

4.3.3. The Metaverse Increasing Productivity and Innovation

Modern societies across the world continue to develop as time goes by. “From the standpoint of end users, three major technological innovation waves have been recorded centered around the introduction of personal computers, the Internet and mobile devices, respectively” (Mystakidis, 2022). Through some of them, especially screens, we are able to perceive a digital environment where people deal with lots of visual information. In fact, it was during last pandemic when everyone has witnessed how the digital world has become an essential support for maintaining most of our daily interactions efficiently. In that sense, a study that made a thorough research about the evolution of agile working during the COVID – 19 outbreak (Schmidtner, 2021) compiled a series of findings regarding the adaptability of companies to the post-pandemic scenario. Among other aspects, it was concluded that the use of mobile hardware and new software capable of integrating remote working, such as video conference, was quite expanded and the transition to home office was rather smooth, expecting that space to “become part of the future work environment” (Schmidtner, 2021).

However, Mystakidis (2022) explained that these 2D environments present several limitations for granting an optimized user experience. In that regard, the continuous contact kept with these technologies is likely to inflict undesired effects, such as Zoom Fatigue. This recent condition is likely to happen because of “a prolonged and inappropriate use of videoconferencing tools” (Riedl, 2022). Some reasonable explanations for this recurrent feeling could be: “Excessive amounts of close-up eye gaze, cognitive load, increased self-evaluation from staring at video of oneself, and constraints on physical mobility” (Bailenson, 2021). Furthermore, users could experience a progressive degree of isolation, followed by a low self-perception, faded presence, inactivity, or a poor emotional expression, among other implicit realities potentially induced by any 2D platform. “All these limitations can be addressed with 3D, immersive spatial environments” (Mystakidis, 2022).

Regarding that last statement, the metaverse offers a wide range of possibilities to promote a more genuine experience when it comes to establishing connections with other people. A clear example is the creation of avatars in the virtual world, which allows users to “engage in the full range of human social and instrumental activities” (Dionisio, 2013). With regards to accomplishing these

interactions between users effectively, avatars in VR are capable of responding to full body tracking commands, involving users in “real-time and more embodied interaction that are similar to face-to-face communication, rather than merely looking at a computer screen” (Freeman, 2020). Additionally, Freeman (2020) also mentioned a wide selection of features are available for enabling fluent and effective communication, either using verbal approaches or not, for example voice input, gestures, proxemics gaze and facial expressions.

On the other hand, people desiring to acquire a proper perspective of any untraveled cities in other countries, or any place of interest also have numerous possibilities for that purpose. City VR Experience, for instance, enables users to enter a parallel world where the entirety of many territories can be explored from infinite points of view thanks to the capabilities of this recreation. As Buhalis, D. described “Dozens of roads, structures, cars, and diverse metropolitan areas are available in the game, each of which has a real-life counterpart”. In other words, in this virtual reality there have been organized over a 3D plan plenty of fundamental urban elements that accurately depict how a certain city would look in real life. However, this goes way further from just being limited to displaying virtual places in a static way, as interaction with the whole environment helps engaging users with a more dynamic experience. They “may wander through the city like a giant, see objects from above and below, scale in and out, alter the climate, and take great photos” (Buhalis D. K., 2022). This is an innovative way of introducing the tourist into the travelling experience from an early stage which did not exist a couple decades ago. Having developed tech advancements like this over the years, now it is presented as an advantageous opportunity for both, consumers and the several tourism destinations. While the latter would showcase their most valuable landmarks to improve their image, the former now could feel more confident about travelling to unknown territories, as they can check beforehand every single point of interest in their trip, as well as organizing everything according to their desires, among other possibilities. As the author explained, “from a tourism point of view, visitors can plan their vacation by viewing the whereabouts of that area and engage with different locations” (Buhalis D. K., 2022).

4.3.4. The Metaverse Applied to Service Selling in Tourism Activities

When potential tourists are given the opportunity of traveling virtually instead of moving to another physical place, their expectations are set particularly high, since they are sacrificing their budget in something that has not been proven to be worth trying yet. That is why it make sense that, “before monetizing the metaverse, hospitality and tourism companies must design immersive experiences that people perceive to be valuable and for which they are willing to pay” (Gursoy, 2022). Consequently, the whole conglomerate of touristic services, infrastructure, employees, and any other element of significance within the metaverse have to be perfectly organized for granting high standards of quality. Regarding this last statement, the author also designed a matrix that can be

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useful for listing the various types of client/user profiles in relation to their interests. The classification depicts a series of activities attending to the user's degree of involvement on them, as well as the motivation for participating. For example, someone searching for leisure in a less interactive way would choose to enjoy virtual shows or virtual safaris, among many other contexts. However, although this matrix is accurate in narrowing down the essential virtual niches, there could be more variables available in the whole spectrum of experiences, considering the wide range of possibilities in the tourism sector.

Motives	Functional	<p>Lifestyle</p> <ul style="list-style-type: none"> - Virtual retailing of NFTs - Travel booking - Educating users 	<p>Promotions</p> <ul style="list-style-type: none"> - Digital twinning of destinations, hotels, and resorts - Augmenting physical experiences
	Hedonic	<p>Designing amusements</p> <ul style="list-style-type: none"> - Virtual flights - Virtual concerts 	<p>Designing adventures</p> <ul style="list-style-type: none"> - Metaverse casinos - Kayaking icebergs - Virtual skydiving
		Low	High
		Interactivity	

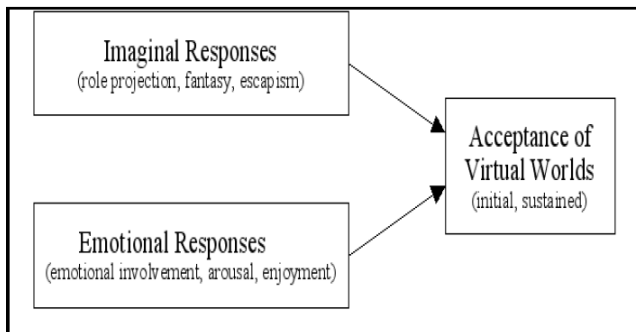
Creating metaverse experiences. Source: (Gursoy, 2022)

Gursoy (2022) also suggested that “players in the hospitality and tourism industry must exhibit ingenuity and innovation to create distinct and immersive experiences capable of engaging customers’ multiple senses.” In that sense, a study on the effects of virtual reality on destination image formation concluded that “the use of VR goggles has a more significant impact on the destination image formation when compared to identical content viewed on a computer, and therefore shows an increased intention to visit a destination” (McFee, 2019). With regards to accomplish this idea, Thomas Cook company elaborated an innovative immersive experience for an advertising campaign called Thomas Cook Virtual Reality Holiday “Try Before You Fly”. With regards to attracting tourists through an original and creative offer, the company firstly arranged several immersive 360 VR videos and then invited clients to enjoy a wide selection of virtual reality destinations, being capable of recreating their future holidays beforehand. In the end, the results were quite positive, since a 190% increase in New York excursions was registered. Therefore, it is appreciable that advertising methods in the metaverse can potentially be quite effective, reaching to the user’s emotions throughout the process, as marketers have the opportunity to generate experiences that make the customer feel as if they were protagonists of their own

story (Kadry, 2022). Moreover, the author suggests that this new way of advertising enables brands to differentiate themselves at the same time they avoid making the customer feel saturated, claiming that “the Metaverse points to move beyond traditional advertising toward creating brand experiences that are more engaging and appealing and less invasive than what we currently experience with digital advertising” (Kadry, 2022).

4.4. Social acceptability

I consider it would be sensible to list the potential arguments that, either locals or visitors, could think about when it comes to creating an opinion with regards to this new scenario. One study suggests that virtual worlds are potentially capable of attracting users by applying the hedonic theory. “The theory focuses on positive behavioral experience: imaginal and emotional responses, which are both key human factors” (Holsapple, 2007). Regarding these factors, the author classifies imaginal responses as role projection, fantasy, or escapism, where enjoyment and arousal stand as emotional responses.



Hedonic Research Framework for User Acceptance of Virtual Worlds (Holsapple, 2007)

Certainly, the metaverse is a space with unlimited possibilities where all these desires can be fulfilled. Proof of that is, as commented before, the possibility for users of creating tailored avatars according to the user’s preferences (Freeman, 2020), as well as their immersion in desired spaces where anyone can stick to a specific scenario and recreate contexts that correlate with their actual desires in the real world (Kadry, 2022). Therefore, it is reasonable to predict an optimistic response to the metaverse in general, as it enables to experience tourism beyond physical limitations.

In practical terms, there is a research article about social acceptability of virtual reality in public spaces (Eghbali, 2019), in which a study was conducted in order to understand the main aspects that have an impact in the experience perceived of “users” dealing with VR devices in public spaces and “spectators” watching the use of VR in public. First, some social experiments were elaborated, in which users wearing the required gear interacted with a VR application and

spectators reacted to the situation. Then, one of the key parts of this study was a survey addressed to both “users” and “spectators” that presented various statements about the use of VR in a Likert scale (Annex E), right after the social experiments. These provided valuable information regarding people’s thoughts in this context, eventually reaching to the following conclusions: “In general, the survey scores are rather positive, and the study participants considered public VR use in this context to be appropriate” (Eghbali, 2019).

Nevertheless, it is necessary to address several aspects that may potentially affect users in a negative way, discouraging them from taking part in any virtual environment. Many people are aware, for example, of their personal data being shared when they perform online searches in any browser, which enables different websites to acquire specific information about them. However, that information is later sold to third parties, without having the any consent of the user. “For the most part, users do not pay attention to how their public data are being used by other parties but show very strong negative reactions when the difference between the actual use of their data and the perceived use of data become explicit and too contrast” (Lee, 2021). This scenario is completely applicable to these emerging platforms that digitize reality. For instance, anyone participating in an MR guided tour visit of a virtual museum would have their personal data gathered and distributed to online advertising agents. Therefore, what should be the most sensible option to avoid rejection to this information treatment is to be completely transparent in the implications of these usages of data and, if possible, reaching agreements with the user on which conditions would be suitable for a fair exchange. In that sense, information markets could be a proper mechanism to properly trade personal information. While it would still be transferred to third parties, but users can obtain various compensations for giving their consent (Lee, 2021).

4.5. Implications of the Metaverse in Environmental Circumstances

On the other hand, the metaverse could be a useful tool to face certain circumstances that affect the environment of tourism. Locals concerned with the preservation of the Islands would find this new way of making tourism as one of the possible alternatives to address some of the negative effects that tourism carries with itself, such as heritage degradation, people agglomerations or traffic jams, among others. In that sense, most sensitive areas could be detected by applying 3D representations of any territory in a virtual environment, as users would have the capability of analyzing carefully critical spots around the place in other to “explore sustainability vulnerabilities” and “alternative environments” (Buhalis D. K., 2022).

Furthermore, the world is currently experimenting the effects aroused from the Russian offensive in Ukrainian territory. The great majority of them directly affect the tourism industry in many ways. According to the UNWTO, in terms of the economy, the rise of gas prices, generalized inflation and higher interest rates

are causing an increase in the overall cost for tourists when it comes to traveling, as well as greater challenges for firms in the tourism sector to keep up their activities. Socially, it warns that the uncertainty generated by this conflict supposes a considerable deterrent for those segments prone to avoid any indication of risk. As a result, many traditional and emergent destinations are starting to become affected, threatening those whose main source of income comes from tourism (UNWTO, 2022). Moreover, statistics gathered from this organization indicate that Russian and Ukrainian tourists represented 3% of worldwide spending on international tourism (Annex F), which could potentially cause a loss of up to \$14.000 million dollars in tourism income globally. The metaverse could behave in this situation as a temporary substitute of the typical tourism alternatives when travelling is not an option for many niches anymore. These groups, especially tourists coming from the US or Asian countries according to the UNWTO, may choose to enjoy tourism experiences virtually, avoiding any potential risk.

5. Analysis

Considering all the essential notions explained before, I may begin my approach to the crucial part of this investigation. The aim of the analysis revolves around the integration of digital platforms, such as VR or AR, and its implications in the Canary Islands tourism offer. Therefore, the following analysis gathers, a compilation of various cases around the territory of the Canary Islands in which the application of extended reality features proves to be helpful in addressing practical scarcities, enhancing the experience perceived by the tourist while they participate in tourism activities or providing environmental, technical, and sustainable solutions to some problematics that could affect the integrity of the tourism environment.

5.1. Culture Tourism

Even though the Canaries preserve centuries of impressive history in the form of a rich cultural heritage, the truth is such potential has not been yet unleashed as a powerful tool for attracting tourists into another way for enjoying what the Islands have in stock. This reality is appreciable regarding data provided by the ISTAC, where only an 8,7% out of all surveyed tourists considered as “very important” the cultural offer of the Canary Islands as a key factor for visiting the place, while other factors such as the weather, its beaches, landscapes, and gastronomy were the most attractive incentives for tourists to choose the islands as their destination (ISTAC, 2021) (Annex D). With regards to addressing the scarce number of tourists interested in cultural activities, initiatives like the strategic plan for the promotion of heritage tourism in the Canaries, finished in 2021, attempt to design a proper development for this type of tourism. It is no surprise that digitalization is one of the main matters of discussion in this project. Therefore, the implementation of the metaverse would play a fundamental role in making this type of tourism more attractive.

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5.1.1. Spatial Recreation of the Tourism Environment

As researcher, journalist and history enthusiast Nacho Navarro displayed in “Futura” TV program, which deals with the latest advancements in technology, there are some destinations currently experimenting with 3D space-recreating devices (Porter et al., 2022, 40:39). It was the case of Valderrobres, whose church and castle have been completely digitalized into a twin virtual space for endless purposes. One of the most interesting applications for my object of study is, among others, the integration of virtual reality into the various historical buildings of the Canary Islands in order to promote and enhance either its cultural offer or to create innovative virtual activities for tourists to take part in. Therefore, I proceed to explain in the following lines the potential of virtual reality in this area. Regarding possibilities enabled by VR, users have the possibility of accessing the premises without the necessity of being transferred to the actual place. The accuracy of this recreations is millimetric, so every single detail from any place is going to be clearly visible to anyone. Speaking of visibility, the point of view from a person’s perspective is no longer limited to standing still on the ground, since virtual visitors could move around every inch of space as if they were flying around. This enables people to appreciate closely certain areas that would remain inaccessible to a regular tourist, such as the altarpieces hanging high inside a cathedral. Moreover, online visitors would not be bothered by potential agglomerations of people in landmarks, as the virtual space exclusively displays those elements inside. Last but not least, if something is required for the cultural heritage to be sold in the metaverse effectively is its proper interpretation of it. One possibility could be to hire competent professionals that would accompany these visitors virtually on their way to understanding the context of every element they see.

In relation to historical heritage sites, the Canary Islands certainly store a wide range of archaeological heritage located around various landmarks. However, its proper diffusion for tourism purposes has not been done properly over the years, although their potential is great enough to be implemented into the Canary Islands touristic offer. Doctor Maria Esther Chávez Álvarez, lecturer in the University of La Laguna whose main expertise field is archaeology, explained during lessons her concern about the evident discoordination between public institutions in charge of the archaeological heritage management. Besides, she claimed that “it is necessary to provide precise studies on how archaeological goods can be integrated in the tourism offer, in benefit of good preservation and the people who enjoy them” (M.E. Chávez, personal communication 2021). With regards to addressing this situation, I will provide practical applications in terms of digitalization possibilities that could potentially be effective for integrating archaeological experiences into the touristic offer in the Canary Islands.

In terms of providing a virtual experience for creating innovative immersive experiences, virtual reality could be applied in order to appreciate the various artefacts that are showcased in museums. The most relevant centers are the

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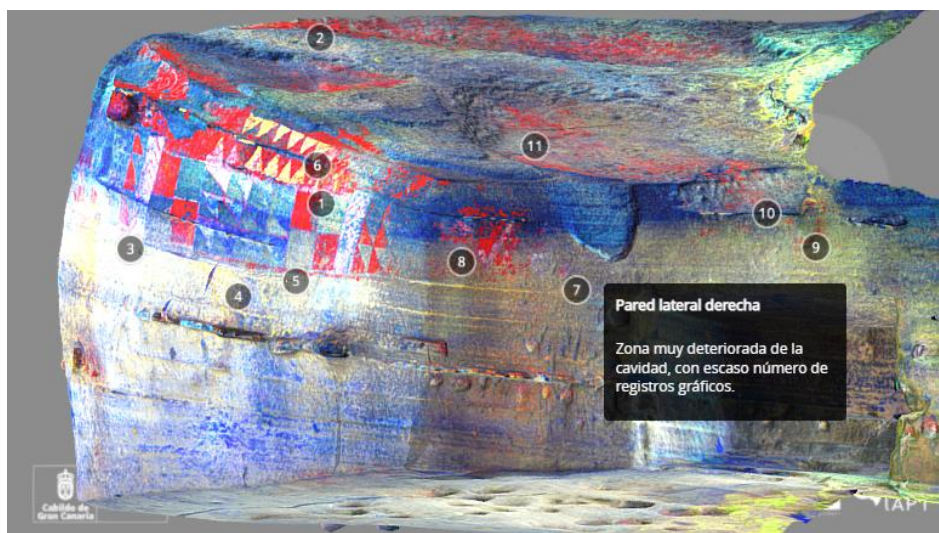
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“Museum of Nature and Archaeology” in Santa Cruz de Tenerife, the “Museum and Archaeological Park Cueva Pintada” in Gáldar, Gran Canaria, the “Beneahorita Achaeological Museum” in Los Llanos, La Palma, among many others. Currently, the museum of Cueva Pintada has been developing a very interesting project in the area of digitalization, where many archaeological materials are being rendered into 3D digital representations applying photogrammetry. In short terms it is a technique capable of “obtaining reliable information about the properties of surfaces and objects without physical contact with the objects” (Schenk, 2005). This way, anyone can browse the Internet and check in high detail all the exact representation from any of these findings, along with an accurate description about its characteristics, background, context, and many other aspects. Besides, it incorporates a VR feature that allows users to observe any element from a more immersive and interactive experience, especially when browsing uploaded virtual spaces, such as digitalized caves. These can be easily inspected and comprehended, as information is not presented as a mere piece of text separated from the site but displayed around the 3D model as we navigate. As it is appreciable, this initiative represents a solid move into the digitalization of cultural heritage, therefore potentially applicable to every single center of archaeological interpretation in the Canaries, such as the ones mentioned before.



Metaverse perspective of a cave in Cueva Pintada Gran Canaria Museum.

Source: <https://sketchfab.com/cuevapintada-grancanaria>

Even so, there are still various implementations for enhancing this experience. In that sense, research made on 3D visualization of cultural heritage artefacts with virtual reality devices intended to improve knowledge amongst various Egyptian funerary objects, for which they employed virtual reality in a similar way as presented in Cueva Pintada’s case. However, in order to deliver

the most immersive experience, they considered the creation of a “VR hub to make available more information and to enhance the cultural offer of a museum”, accessible when using a “reality head-mounted display” (Gonizzi Barsanti, 2015). In other words, apart from accessing the 3D models of every element, a virtual environment would be set according to the theme presented, in this case, in relation to the Egyptian culture. Moreover, inspection of these virtual assets would not be limited to just scrolling around with a mouse, a touchscreen, or any traditional digital devices, since they also implemented an optical hands tracker capable of interacting with them directly with the users’ hands. As Gonizzi Barsanti (2015) explained, both devices combined “allow users playing, grabbing, moving and rotating the 3D models in the VR scenario”.

In terms of integrating the depicted scenario, the author also commented two obstacles derived from the application of these virtual environments, which are the extended economic cost of its development and the usual lack of space in museums. Thus, when attempting to implement all these proposals in archaeological historic centers around the Canary Islands, experts in this field and public institutions have to consider whether it is reasonable to invest in such expensive installations for enhancing the tourism offer in such sites. Besides, the territory where such centers are located could represent fragile environments with plenty of heritage value accumulated over time, so meticulous assessment and planification would be required in order to understand if the implementation of such virtual spaces is logical and respectful with their surroundings. Nevertheless, these impediments can be addressed by sticking to an uncomplicated use of virtual reality experiences, where “low-cost, small and light devices can be combined in order to produce a simple to use, friendly and realistic application” (Gonizzi Barsanti, 2015).

5.2. Ecotourism

The Canary Islands are host to a wide variety of natural spaces spread across the territory where many different landscapes can be discovered, ranging from coastal areas to mountainous regions and presenting unique singularities due to the volcanic nature of the territory. For instance, I may include Los Gigantes Cliffs, Anaga rural park or Masca Valley among the most popular in Tenerife. Additionally, if there is one landmark that represent a “must” for visitors in this island is the Teide National Park, as, according to ISTAC, 5 in 10 tourists travelling to Tenerife include the highest mountain of Spain to their trip (ISTAC, 2021). However, there are plenty of locations with great potential for luring tourists which usually blend in and do not get too much attention in comparison with the most widely known spaces.

5.2.1. Promotion of Natural Spaces with VR

While tourists can move freely between places and decide where they want to travel, it would be beneficial for both, visitors and the environment, to generate awareness and value among those suitable locations that could potentially welcome the arrival of tourists but remain usually unknown. In that sense, visitors

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would discover new spots that they could not consider before, and the flow of tourists would be more balanced, therefore achieving a more equal distribution of them.

For instance, according to ISTAC (2021), only 3.9% of tourists planning their holidays in Tenerife make a trip to Baranco del Infierno, a splendid hiking site with beautiful rocky surroundings located in Adeje. An effective way to promote these kinds of places using VR was proposed in a study about tourist's experience of Virtual Reality Applications (Jung, 2017). Participants in this experiment were given VR gear that showed a 360° footage of a natural environment from a drone's bird perspective to then analyze their experience. In the end, the study concluded that "tourists welcome the opportunity to experience destinations virtually in order to get a better understanding of destination's offerings" (Jung, 2017). Therefore, if a similar VR project is applied in Barranco del Infierno, tourists are more likely to visit it, as they can appreciate its wonderful landscapes from a very immersive and versatile point of view.

5.3. Environment Preservation Applying Extended Reality

In this part of my work, the intention is to present logical explanations on how virtual reality behaves as a mean for preserving any form of cultural heritage in many practical cases. Retaking the forementioned researcher's speech on digitalizing physical spaces, he also mentioned a really important aspect in relation to digitalizing any form of cultural heritage, which was the capacity of saving years of history in case some devastating catastrophe occurs (Porter et al., 2022, 40:39), potentially wiping out parts or entire historical assets.

If we search for recent cases, Notre Dame cathedral in Paris suffered a fire that inflicted harm in some elements of the structure. In the aftermath, the spire on top collapsed and the upper walls presented severe damage. However, thanks to a previous scanning of the entire structure between 2014 y 2015, now it is possible not only to help in its restoration, but maybe, even attempt to display in VR how some structures would look before the fire struck them. Therefore, it is appreciable that conservation of human heritage elements is able to evolve towards more efficient methods. Initiatives like this one aim to protect those sensitive cultural heritage environments that are dangerously exposed to various types of harm, such as natural or human-inflicted degradation. A case of natural degradation would be the case of Cueva del Agua in El Hierro, where cave walls present a progressive deterioration of its materials, threatening the integrity of several cave engravements spread along the place. In order to study, control and understand this process of degradation, a group of experts is using specialized devices that capture 3D images to acquire a precise representation of reality, which gives way to develop an in-depth analysis throughout the place. Moreover, as it was explained before, this could also be one of the many locations subject to be uploaded to the metaverse and serve as another virtual attraction while being responsible with the preservation of iconic caves, as any kind of harm would be inflicted on it. Regarding human degradation of this place, the capability

of digitalizing an exact representation of this environment could reduce the potential threat of tourists repeatedly deteriorating its elements, as “virtual tours can also be used to help preserve heritage and/or improve opportunity by giving visitors access to a simulation, rather than placing the original at risk of wear and tear” (Arnold, 2007).

5.4. Leisure Tourism

Regarding the tourism leisure offer of the Canary Islands, the hospitality industry always has been one of the most relevant factors, as it allows tourists to be properly accommodated to then get involved in the various activities around the territory. In statistic terms, while 37.8% of tourists consider the accommodation supply as “quite relevant” for choosing the islands, 61.1% of them enjoy the services provided by hotel facilities when they travel there among other activities, spending an average time of 7.7 hours outside of them, which means most of the time is spent indoors (ISTAC, 2021). Such data asserts the importance for hotels of achieving an optimized high-quality offer to keep generating value amongst potential visitors.

5.4.1. Virtual Reality in Advertising Hotels

In this section, I will explain how hotels may employ virtual reality for generating an optimized attractive offer to potential visitors in order to analyze the potential benefits of promoting hospitality services through virtual environments. After carrying out a study on the effectiveness of virtual reality advertising, researchers found “that hotel VR commercials elicited better immediate advertising effects than traditional video commercials in terms of ad recognition, ad attitude, brand attitude, and purchase intention” (Leung, 2020).

Regarding these logical conclusions, Riu Hotels & Resorts have been working on a project to implement virtual reality in their offer. As the company explained on their web page, they have digitalized a few sections of Riu Plaza España, one of its most iconic hotels in Madrid, which makes this company the first one to use virtual reality in Spain. These areas are their transparent balcony along with its catwalk at more than 100 meters of altitude, the interior of hotel rooms and its lobby, among others. With regards to creating a more immersive experience, they have introduced interactable elements in many parts of this metaverse, as well as the possibility to speak to the receptionist through the virtual lobby. These features enable potential customers to pick up virtual assets from several locations in the hotel for its inspection, as well having an interactive space in the metaverse where the receptionist will remain available in both, the real and the virtual world. Thanks to this last implementation, the whole process of making a reservation is not just limited to the traditional methods of booking online. Currently, future guests from this hotel have available now the alternative of putting on virtual devices, diving into the metaverse and experiencing how the physical interaction that takes place in the reception can be transferred to a digital environment. Furthermore, Riu Hotels & Resorts adopted an interesting incentive

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for virtual visitors to enter their metaverse space. Somewhere around the various locations of the hotel there is one hidden prize for the first virtual visitors exploring the facilities (Riu Hotels & Resorts, 2022). These innovative experiences are the key for generating an attractive image and differentiating their products from the competition.

Regarding the Canary Islands, there are plenty of remarkable hotels spread around their territory with exceptional facilities, amenities and unique landscapes that surround them. In terms of digitalization, some of them have developed a few technological implementations in order to improve their service quality through digital applications. It is the case of the Botanic Hotel in Tenerife, which invested a portion of their funds in a versatile transformation of their structures, including digital devices for allowing contactless payments and online check-ins (Hosteltur, 2021) . Still, they did not consider extended reality as part of their reconversion, though hotel premises possess several unique locations that could be subject to experiment metaverse experiences. Apart from those mentioned in Riu Plaza España's case, this hotel is host to a 25.000 m2 extension of beautiful gardens with lots of different plant species where people go to relax and enjoy the healthy environment. This initiative would allow them to be the first hotel in Spain to upload a digital garden, which would earn the place worldwide recognition and plenty of added value to their offer. Tourists who firstly experiment the VR garden experience would be amazed by such experience and will probably desire to live the experience physically at the real place. Therefore, through this "try before you buy" experience, they will be capable of attracting more tourists and would become referents among the Canary Islands in virtual reality innovations.



Garden of the Botanic Hotel in Puerto de la Cruz, Tenerife. Source: <https://www.hotelbotanico.com/es/galeria/>

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6. Conclusions

The world in which we live is undergoing a continuous process of digitalization, which has been made possible thanks to the advance of new technologies. New ways of performing a wide variety of tasks have emerged in this area, from the way people interact with each other to the processes carried out in companies. Although digital users are still in contact with a traditional 2D digital environment at the moment, the truth is that another one is being developed by applying different extended reality methods. In that sense, the concept of the metaverse is becoming increasingly popular, as well as the different ways of accessing this digital world, mainly through virtual reality, augmented reality and mixed reality platforms. The uses of this 3D environment are being studied in detail, and in recent years very interesting proposals have been developed to integrate these platforms in different contexts, being tourism my focus in this study.

This study has proven that digitalization has become a relevant feature that should be integrated in tourism environments, activities, products or services in order to provide an increase in quality. First, I commented on the usefulness provided by this environment to then analyze different applications that extended reality could facilitate in the tourism environment of the Canary Islands. In the culture tourism area, I analyzed the use of spatial recreation in certain environments where different forms of historical heritage can be found. In terms of practical uses, I observed that this was an excellent method for uploading exact replicas of any artifact or space to digital platforms, which can be used to examine them in more detail. Additionally, this study found that spatial recreations were an effective method to scan heritage spaces threatened by any kind of degradation for assessing possible solutions, as well those affected by any source of damage in order to organize its restoration. On the other hand, advertising hotels through the metaverse has been shown in this research as a resourceful feature that few companies have started to implement, but those that took the initiative are perceived as innovative at the same time product and service quality improves. Eventually, I presented the application of virtual reality devices on natural environments as an advantageous tool that can be useful for potential tourism spaces to gain recognition among tourists, therefore redistributing the flow of visitors more equally across the territory.

In conclusion, extended reality in tourism has the capacity of enhancing the experience of tourists in the Canary Islands. The sooner it becomes widely spread in the archipelago, the more attraction and value perceived would generate there.

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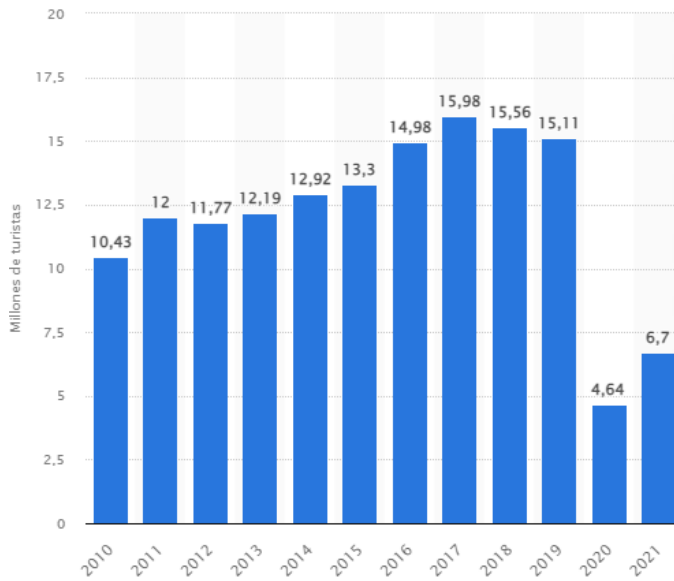
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Annexes

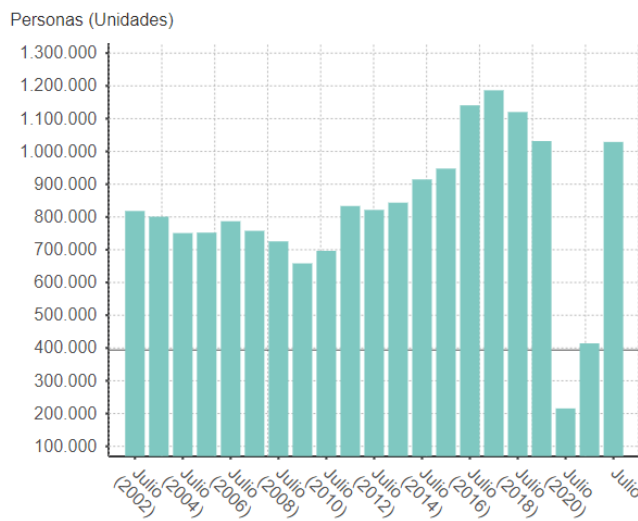
Annex A



Annual evolution of tourist arrivals in the Canary Islands from 2010 to 2022.

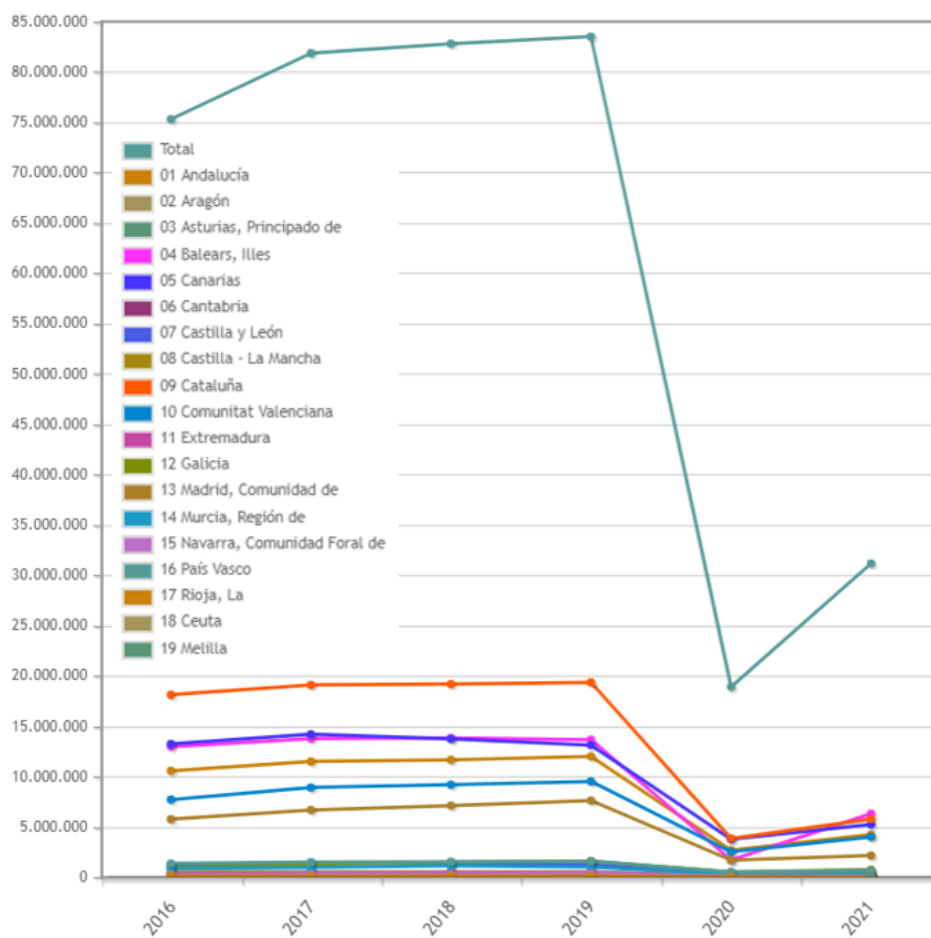
Source: (Statista, 2022)

Annex B



Monthly evolution of international tourist arrivals in the Canary Islands in July over the years. Source: (Turespaña, 2022)

Annex C



Number of international tourists arriving to Spain per region (2016 – 2021)
(Source: INE)

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Annex D

	Tenerife	Canary Islands
Climate	75.8%	76.0%
Safety	47.7%	49.0%
Sea	46.9%	52.0%
Tranquility	45.7%	48.5%
Landscapes	43.5%	39.1%
European belonging	39.0%	40.2%
Environment	37.4%	34.7%
Beaches	37.1%	44.6%
Accommodation supply	35.6%	37.8%
Effortless trip	33.2%	34.9%
Price	33.0%	32.4%
Gastronomy	29.2%	27.9%
Authenticity	24.5%	24.4%
Fun possibilities	23.1%	22.4%
Exoticism	15.6%	14.5%
Hiking trail network	14.1%	12.1%
Historical heritage	9.2%	9.1%
Culture	9.2%	8.7%
Shopping	8.9%	8.8%
Nightlife	7.4%	8.4%

Importance of each factor in the destination choice, comparing Tenerife and the Canaries in general

https://turismodeislascanarias.com/sites/default/files/promotur_tenerife_2021_en_0.pdf

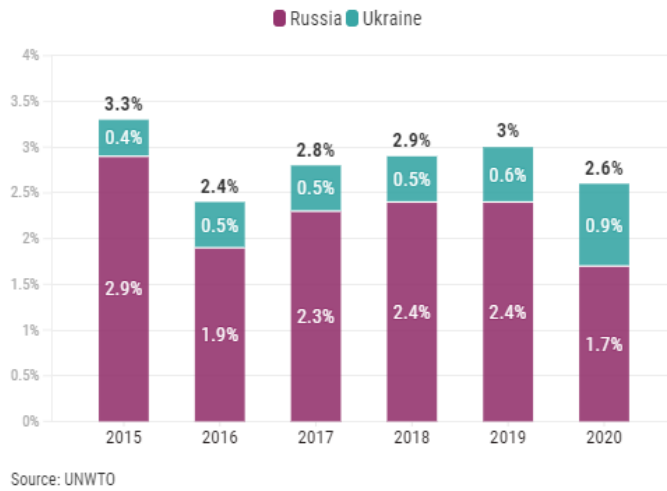
Annex E

Statements	Users	Spectators
Statements about public VR		
S1. It felt appropriate to use the VR headset in a public place.	5.3 (0.8)	4.9 (1.1)
S2. It felt rude to use the VR headset in a public place.	2.1 (0.7)	2.8 (1.2)
S3. It felt uncomfortable being watched by others while using VR in a public place.	3.6 (1.4)	2.7 (1.2)
Statement about the user		
S4. I think the VR headset makes me look cool	4.6 (1.5)	4.3 (1.5)
Statement about public communication		
S5. It would be useful for me if the people around me could communicate with me.	5.4 (0.8)	4.7 (1.4)
Statements about interaction		
S6. It felt awkward doing head movements while using VR in public.	2.8 (1.5)	3.7 (1.2)
S7. It felt awkward performing body movements and hand gestures while using VR in public.	3.6 (1.7)	3.9 (1.2)
Statements about isolation		
S8. I did not like the fact that I was isolated from the rest of the people in a public space.	3.4 (1.6)	4.6 (1.6)
S9. It would be interesting if the other people could see what I was doing and seeing in the VR.	5.8 (1.5)	6.0 (3.5)
Statement about privacy		
S10. I was concerned about spectators recording me while using VR in public.	2.8 (1.5)	3.5 (1.0)
Statement about safety		
S11. I was concerned about bumping to objects and people while using the VR in public.	6.1 (0.7)	N/A

Mean values and standard deviations of user (N=10) and spectator (N=30) surveys. 7-point Likert scale was used (1=strongly disagree,7=strongly agree). Source: (Eghbali, 2019)

Annex F

**RUSSIA AND UKRAINE'S INTERNATIONAL
TOURISM SPENDING (% OF WORLD TOTAL)**



Russia and Ukraine's International Tourism Spending. Source: (UNWTO, 2022).