

Héctor Cardona-Reyes
Editor

ITHGC 2022

**International Tourism, Hospitality &
Gastronomy Congress**

**Universidad San Ignacio del Loyola, Lima-Perú
October 27th and 28th 2022
Proceedings**

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Preface

The School of Hospitality, Tourism, and Gastronomy of Universidad San Ignacio de Loyola present the III International Tourism, Hospitality, and Gastronomy Congress (ITHGC-2022), on October 27 and 28, 2022. It is held with a prospective vision of digital transformation and sustainable development, assessing the possibilities of economic, social, and environmental development from the tourism and gastronomy sector.

ITHGC-2022 is a 100% virtual congress that offers a space for dialogue, reflection, and dissemination of knowledge and experiences related to innovation and technology, culture, sustainability, and governance. ITHGC-2022 brings together experts, researchers, academics, and professionals from the sector at the international, national, and regional levels.

ITHGC-2022 covers the areas of technology in tourism and the tourist experience, generations, and technology in tourism, technologies applied to sustainable tourism, tourism governance challenges, Cultural Heritage and technologies applied to culture promotion, and information systems and technologies.

Tourism is a sector with the potential for the development of new products and related services. With globalization, new ways of carrying it out have been formed and, through information and communication technologies, new trends are being generated in the sector and the companies are ready to undertake. These trends include emerging technologies such as applications for mobile devices, virtual and augmented reality, and intelligent systems, among others.

In many countries, tourism has become an important source of income, and guaranteeing the sustainability of cultural or natural wealth, on which tourism generally focuses, requires articulating the work of academia to ensure its sustainability and permanence over time.

This brings with it a diversity of challenges that must be faced, such as the adoption of these new trends; generating strategies for communication and diffusion; implementation of sustainable measures to preserve the environment and the intelligent use of resources through technology; investing in research that allows companies to be more competitive; complying with governmental norms and guidelines for sustainable use.

The objective of ITHGC-2022 is to have a means of reflection and dissemination of knowledge and experiences related to innovation and technology, culture, sustainability, and governance. It brings together the work of experts, researchers, academics, and professionals in the sector at the international, national, and regional levels.

November 2022

The editor.

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Image of a Tourist Attraction and Psychographic Profile of the Tourist: Data Mining Approach

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Abstract.

The goal of this research is to understand the image of an attraction from the national tourist point of view and its psychographic profile. The study was made in relation to the Archeological Sanctuary of Pachacamac in Lima, Peru. For this purpose, unstructured data mining—a cutting-edge method—was used. In order to get relevant data, 209 comments from *TripAdvisor* were collected, while for the *Big Five* personality analysis, five comments per visitor about different places were processed to determine their psychographic profile (a total of 1045 comments). Through qualitative research method, terms that describe the touristic image of this place were identified, which were then analyzed using the *Lexalytics Software* to determine the related keywords, their emotional valuation, and frequency. The applied research design was phenomenological, as we sought to know about the visitor experience of the tourist. Results indicated a positive perspective on the image of the Archeological Sanctuary of Pachacamac by visitors due to how close they are to the location—the site’s museum, the historical weight that precedes this place, cultural tourism, and the services provided there. Moreover, it was noted that most visitors were men (75.60%) from the *X Generation* and *Baby Boomers* and they are basically liberal, artists, organized, hard-working people, contemplative, and kind. This data contributes to better decision-making, generating use full information that could be used by tourism professionals and those in charge of the destination’s management.

Keywords: Tourist image, Data mining, Psychographic profile.

1 Introduction

The image of the tourist attraction is viewed as the whole idea represented in the mind of the traveler, which could be a result of the perception of the characteristics associated with the place they are visiting (Groen, 2012). The image arises from the very same visitors that go to the destination (Baloglu, Henthorne & Sahin, 2014). Beerli and Martín (2004) assert that the gathered information after a visit or a personal experience in the destination contributes to the creation of the place’s touristic image. Thus, studying the touristic image allows for the identification of differences between what it is offered and what the visitor perceives (Kaur, Chauhan & Medury, 2016). This facilitates decision-making, the design of marketing strategies, and the management of the destination. Furthermore, through the psychographic study, detailed information on the lifestyles, activities, interests, and opinions of the visitors can be obtained in order to find out the profile of the people who visit a destination (Moutinho, 2020).

Due to the coronavirus disease (COVID-19) and with the purpose to reactivate the sector’s economy, many countries are carrying out advertising campaigns via digital platforms, TV, radio, and other more innovative media, using tools such as *big data*, where structured and unstructured data can be found. It is important to mention that all these campaigns focus on national tourism due to the

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traveling restrictions that some countries are still implementing and also because of the national tourism volume, which is six times greater than international tourism (OMT, 2020). It must be stressed that unstructured data mining allows for the transformation of unstructured information into systematic patterns or behaviors that can be used by tourism professionals through marketing strategies, easy access to information for an effective tour-operation, management of questions and complaints, etc. (Bucur, 2015). The right projection of a touristic image is a key factor to establish the competitiveness, recognition, and positioning of a place. This way, marketing strategies can be established as well as the delivery of a satisfactory touristic product in keeping with the projected touristic image (Camprubí, Guia & Comas, 2008).

This research aims at proving that the use of free availability unstructured data in text format can be used in academic research (Groen, 2012). The web has become a wide resource to obtain this kind of information, whose content is a valuable contribution to organizations as well as for decision-making (Gupta & Rathore, 2013). Plenty of information on different topics can be found online, such as processed documents, e-mails, audio, videos, and texts (Anderson, 2016). This includes free-access platforms such as *TripAdvisor*, where travelers exchange information about their experiences (Godnov & Redeck, 2016). The use of free-text format data help in the carrying out of more research in tourism given its unobstructed availability and easy accessibility (Gretzel & Yoo, 2008).

Table 1.

Arrival of national tourists to the Archeological Sanctuary of Pachacamac.

YEAR	2015	2016	2017	2018	2019	2020
Number of visitors	86028	112627	105237	108680	118726	12226
Growth percentage	5.85%	30.92%	-6.56%	3.27%	9.24%	-89.70%

Source: Ministry of External Trade and Tourism, 2020.

The development of domestic tourism contributes to the knowledge and valuation of the culture, and fosters a sense of belonging, and pride in what belongs to the region. According to World Tourism Organization (UNWTO - 2020), domestic tourism is being used as a tool to reactivate the sector. To this, it must be added that the proportion of domestic tourism in Peru is 92% higher than foreign tourism. Moreover, studying and understanding the image of this attraction and linking it to the psychographic profile of the visitors becomes useful to improve web contents and the promotion provided by the management of the Archeological Sanctuary of Pachacamac, the Ministry of Culture, and the Ministry of External Trade and Tourism.

This research proposes to integrate the development of the psychographic study through data mining to be executed for specific research in the tourism field.

2 Literature Review

2.1 Factors of a touristic destination image

Beerli and Martín (2004), after going over the attractions and characteristics in the existing scales, propose the inclusion and classification of all factors that influence the appreciation of the image created by the individuals in nine dimensions, namely, natural resources, political and economic factors, natural environment, social environment, and overall environment of the place. The researchers also highlight the selection of characteristics that are used in the design of a scale that will greatly depend on the attractions that each destination has, their positioning in the market, and on assessing the goals of the image that the individual may perceive.

Conversely, Baloglu and McClavery (1999) present a model that allows for understanding the factors that influence the creation of the touristic image of a destination. According to the proposed model, it can be observed that in the creation of the touristic image of a destination, there are two core factors of influence. On the one hand, we have the stimulus factors, which are secondary sources of

information (can be induced, organic, or autonomous), and primary sources of information (life experience and intensity of the visit). On the other hand, we find personal factors, which can be determined by the motivations, psychographic profile, and sociodemographic characteristics of the individual. These factors directly influence the destination image perceived in the perceiving/cognitive image, and in the affective image, as well as, consequently, in the overall complex image of the destination (Beerli & Martín, 2004; Baloglu & McCleary, 1999; Gartner, 1993).

2.2 Unstructured data mining

These are information-gathering processes based on statistical analysis, database methodology, and mathematical algorithms. They are built to discover useful information within unstructured data that have patterns or systematic behaviors that present the existent relations between the data in order to predict trends and behaviors (Olmeda & Sheldon, 2001). In other words, unstructured data mining does not have a predefined format, is not ordered, is hard to categorize, and can be found in many forms, such as social media and web pages (Gretzel & Yoo, 2008; Kaur, Chauhan & Medury, 2016). However, that information can be turned into a format that allows being worked on in order to identify patterns. In other words, it is possible to give it a structure that allows for the collection of information and carrying out a content analysis (Tsujii, Takahashi, Fujita & Tsuda, 2014). A clear example is what Jalbani, Memon, Memon, Depar, and Koondhar (2018) point out; they performed the processing of comments from different social media in Cloud Natural Language to identify the feelings of the users about opinions on social media.

2.3 Psychographic profile

Demby (1994) defines psychography as “the use of psychological, sociological, anthropological factors as desired benefits from the desired behavior, self-concept and lifestyle” (p. 1). Psychography is developed through the discovery of several consumer typologies, becoming the most relevant factor due to its psychological diversity (Sarli & Hon, 2011). Additionally, Hsu, Kang, and Wolfe (2002) point out that “psychography is the development of consumer psychological profiles, being psychologically based on the measures of different life models or lifestyles” (p. 4). By applying psychography, diverse aspects of consumers can be analyzed, such as thoughts, reflections, lifestyles, personality traits, demography, socioeconomic level, and expenditure level (Sarli & Hon, 2011; Tintaya, 2018).

2.4 Big Five personality model

For a long time, a large number of researchers have studied the validation of personality measurement; many agree that there are five personality factors (Barrick & Mount, 1991). According to Zhao and Seibert (2006), the *Big Five* model provides a complete classification of the personality, each of the dimensions broadly describe psychological functioning, which is composed of more specific traits.

In this sense, authors Costa and McCrae have posed the most developed operational model of the *Big Five* (Zhao & Seibert, 2006). First, openness to experience: characterizes people that are intellectually curious and tend to seek new experiences, and explore ideas (Zhao & Seibert, 2006). It also describes the curiosity and the artistic side of people (Verma, Kumar & Chandra, 2017). Individuals with high levels of openness to experience are creative, innovative, imaginative, reflexive, and not so traditional. On the contrary, individuals with low levels of openness to experience are characterized as being conventional, of limited interest, and not so analytical (Costa, Busch, Zonderman & McCrae, 1986; McCrae & John, 1992; Zhao & Seibert, 2006). Second, conscientiousness: indicates the level of organization, persistence, hard-work, and motivation of an individual when seeking to achieve a goal (Costa, Busch, Zonderman & McCrae, 1986 and Zhao & Seibert, 2006). Unlike the other dimensions, it is composed of two sides: motivation for achievement and reliability (Barrick & Mount, 1991). It is also defined as the tendency to self-discipline, responsibility, and sticking to rules (Verma, Kumar & Chandra, 2017). Third, extraversion: allows understanding up to where a person is assertive, dominant, energetic, active, communicative, and enthusiastic (Zhao & Seibert, 2006). Individuals with a high level of extraversion tend to be joyful,

very sociable, love to have fun, and are constantly looking for external emotions or stimuli (Costa, Busch, Zonderman & McCrae, 1986; McCrae & John, 1992; Zhao & Seibert, 2006). However, individuals with a low level of extraversion prefer to spend more time alone, and are very reserved, calm and independent (Costa, Busch, Zonderman & McCrae, 1986; McCrae & John, 1992; Zhao & Seibert, 2006). Fourth, kindness: evaluates the interpersonal orientation of each individual (Zhao & Seibert, 2006).

3 Methodology

This research addresses the image of an attraction using unstructured data mining, which is a cutting-edge method that can be used by tourism professionals (Godnov & Redeck, 2016). It is worth mentioning that this method benefits from the amount of content in free-text format (Gassiot, 2012). Moreover, data was collected by means of verbatim opinions (comments about own experiences), and they were analyzed with the purpose of understanding the most eye-catching characteristics of the attraction.

Based on the above, this is descriptive and qualitative research, as components related to the image were identified in order to submit them to in-depth analysis, for that purpose, the software Lexalytics was used to determine keywords related to the attraction's image as well as their emotional valuation, and Apply Magic Sauce to learn about the psychographic profile of the visitors (Hernández, Fernández & Baptista, 2014). To determine the touristic image, 209 assessments were employed made by travelers that visited the Archeological Sanctuary of Pachacamac from January 2015 to March 2020, who left their comments on TripAdvisor. Five comments from different places were processed in order to know about the Big Five personalities of each user that takes part in the sampling. A total of 1,045 comments were processed.

The collection process was made in October 2020. All comments were captured in English (original comment in Spanish) and subsequently evaluated with Grammarly in order to correct grammatical, contextual, and spelling mistakes.

4 Findings and debate

Table 2.

Concepts related to the Areas–Services within the Archeological Sanctuary of Pachacamac.

Keywords	Frequency	Emotional score
Museum	High	+3.32 (positive)
Well-trained guides	Medium	+1.83 (positive)
Visitor center	Medium	+1.61 (positive)
Toilet facilities	Medium	+1.49 (positive)
Wide areas	Medium	+1.48 (positive)
Well-signaled paths	Medium	+0.78 (positive)
Several sections	Medium	+0.66 (positive)
Interesting gift shops	Medium	+0.65 (positive)
Good staff	Medium	+0.61 (positive)
Cozy cafeteria	Low	+0.48 (neutral)
Specific stops	Low	-0.82 (negative)

The term “museum” is the one with higher frequency among the terms related to the complementary areas and services that visitors can enjoy within the Archeological Sanctuary of Pachacamac. It gets a positive connotation (+3.32), and that is because the museum was remodeled and adjusted to the attraction's characteristics, thereby causing a positive impact on the visitors. The museum has to be visited to understand the history and chronology of the cultures that are developed in the sanctuary. Moreover, guides are provided in the attraction, among other services. The national tourist

uses the term “well-trained guides” (+1.83) to refer to the work that the guides of the place do in assisting and informing visitors. Among other terms of medium frequency, there are: “visitor center” (+1.61), “toilet installations” (+1.49), “wide areas” within the attraction (+1.48), “well-signalized paths” (+0.78), “several sections” or divisions within the sanctuary (+0.66), an “interesting gift shops” (+0.65), and “good staff” (+0.61). Visitors express a positive emotion toward the services that are offered within the attraction. Among the low-frequency terms, we can find “cozy cafeteria” (+0.48), even if it highlighted the good service offered by the cafeteria, the circuit per se did not exceed the visitor’s expectations, that is why the term was scored as neutral, and “specific stops” (−0.82), which make reference to the touristic bus stops in order to listen to the guide’s explanations, were negatively evaluated because some visitors would rather walk, expressing that the tour would be more enjoyable if done by foot. However, that is not an option as there are people who do not respect the heritage and damage the place.

Table 3.

Concepts relates to the Touristic Activity- Sustainability.

Keywords	Frequency	Emotional Score
School trip	High	+0.02 (neutral)
Restoration works	Medium	+2.39 (positive)
Cultural tour	Medium	+0.74 (positive)
Touristic resource	Low	+0.35 (neutral)
Receptive tourism	Low	+0.35 (neutral)
Low investment	Low	+0.01 (neutral)

The national tourist considers that the term “school trip” is highly associated to the touristic activity that is carried out in the attraction. However, it gets a neutral valuation (+0.02), taking into account that the Archeological Sanctuary of Pachacamac is one the most visited attractions by students, with more than 50% of X Generation visitors. Likewise, “restoration works” being done in the sanctuary are very valuable to visitors, since the sanctuary is being preserved and new national archeology findings can be discovered. It also gets a positive connotation (+2.39). It is also thought that, in the past, there were “low investment” in the maintenance and research works, for being one the most important touristic centers in Lima. However, currently, the biggest concerns are maintenance and preservation of the attraction. On the other hand, regarding the touristic activity, the “cultural tour” is the most common due to the sanctuary characteristics. It gets a medium frequency and a positive connotation (+0.74). Pachacamac hosts the history of different civilizations. It is the perfect place for cultural tourism.

Table 4.

Concepts related to the Emotions that the visit to the Archeological Sanctuary of Pachacamac generates.

Keywords	Frequency	Emotional score
Magical setting	Alta	+0.44 (positive)
Wonderful sight	Alta	+2.71 (positive)
It is definitely worthy	Alta	−0.10 (negative)
Fascinating place	Media	+2.81 (positive)
Great experience	Media	+1.82 (positive)
Must-see spot	Media	+1.00 (positive)
Amazing history	Media	+0.52 (positive)
Bad feeling	Baja	+0.35 (neutral)
Full discovery	Low	−0.75 (negative)

The emotions generated by the visit to the Archaeological Sanctuary of Pachacamac have been diverse, with valuations ranging from positive to negative. In this sense, the term that obtained the highest frequency is that of Pachacamac, a “magical setting,” the visitors have in mind all the history

that it houses due to the passing of different cultures, this term receives a positive connotation (+0.44). Moreover, visitors consider that the sanctuary provides a “wonderful sight” (+2.71), and that could be because the attraction is located very close to the Pacific Ocean and, from Templo del Sol, an impressive view of Lurín and the ocean can be enjoyed, especially if the visit takes place during the afternoon to watch the sunset, as many visitors’ stress: “it is definitely worthy” to visit the attraction and to experience what it has to offer. Even though it is scored with a high frequency, this term receives a negative connotation (−0.10), because many visitors consider that, in spite of being close to the city and presenting cultural and historical richness, not everyone is willing to visit and enjoy its wonder. Terms of medium frequency such as “fascinating place” (+2.81), “great experience” (+1.82), “must-see spot” (+1.00), and “amazing history” (+0.52) are perfectly complemented with the high-frequency terms, and they generated a positive feeling in the visitors. Finally, the national tourist considers that the ruins of Pachacamac are in “full discovery,” that archeologically speaking it is a place with a lot to offer and that it is still being discovered, which is why it receives a negative connotation (−0.75).

Table 5.
Concepts related to the scores Museum–Historical Aspects

Keywords	Frequency	Emotional score
Pachacamac God	High	+0.27 (neutral)
Religious center	High	+0.81 (positive)
Main sanctuary	High	+0.55 (positive)
Religious authorities	Medium	+3.32 (positive)
Ritual objects	Medium	+3.03 (positive)
Interesting museum	Medium	+1.92 (positive)
Gold plates	Medium	+1.54 (positive)
Nice collection	Medium	+1.49 (positive)
Excellent design	Medium	+1.49 (positive)
Artistic sense	Medium	+0.66 (positive)

This cluster makes reference to the scores that the museum receives as well as the historical aspects. In this sense, about historical aspects, it must be mentioned that the term “Pachacamac God” (+0.27) has a high frequency, but at the same time it gets a neutral valuation. This is because the Pachacamac God was the most asked Oracle of the Andean world, able to predict the future and control the movements of the Earth and constantly mentioned in the tours, and therefore, visitors remember him. Additionally, the terms “religious center” (+0.81) and “main sanctuary” (+0.55), are mentioned, which present a high frequency and positive valuation, since Pachacamac has been the main religious sanctuary of the central coast for thousands of years. The term “religious authorities” (+3.32) is also used with medium frequency and positive valuation to refer to the cult that priests of the Pachacamac God managed. Moreover, tourists assess the museum as an “interesting museum” (+1.92), of “excellent design” (+1.49), with “artistic sense” (+0.66), and have a “modern room” (+0.52), all these items with medium frequency and positive valuation, since the museum has a contemporary design, which construction lays in keeping with the archeological site with modern exhibition areas, with good lighting and distributed following a proper museography script that seeks to enrich the experience of the visitors. On the other hand, regarding the objects shown to the tourists, it was mentioned that the museography counts on “ritual objects” (+3.03), “gold plates” (+1.54) and a “nice collection” (+1.49), since the goal is to show the richness of the collections that this museum houses through a series of sections. These last terms were mentioned at a medium frequency and had a positive valuation.

Xu, Z., Zhang, H., Zhang, C., Xu, M., and Dong (2019), in their research, point out that museums promote the economy and serve as a point of attraction for a tourist destination so it helps residents and visitors to understand the local culture, as they can represent the image of a destination. The image of a museum is a factor that greatly influences the positive emotions of a tourist so that the interpretation service, exhibition, guide service, and the museum environment have a relevant role in their behavior.

Therefore, an adequate image and service allow attracting more tourists. Regarding the Pachacamac museum, it should be mentioned that most of the keywords found reflect positive emotions and scores about the services offered. This results in an adequate image of the sanctuary, as this place serves as a prelude to the visit to the ruins and is a welcoming space for visitors, showing the main findings of the sanctuary and facilitating the understanding of the history that preceded it.

First, regarding openness to the experience, the results of the Apply Magic Sauce show that 86.12% of the analyzed individuals are liberal and artistic, in other words, creative, innovative and imaginative people, unlike the 13.88% of the analyzed individuals, who are described as conventional and of limited interest, that is to say, conservative and very traditional people (Zhao & Seibert, 2006; Verma, Kumar & Chandra, 2017). Second, regarding conscientiousness, the results present that 83.25% of the individuals are organized and hard-working people, who are persistent and are always in pursuit of achievement. On the other hand, 16.75% of the individuals are spontaneous and impulsive (Costa, Busch, Zonderman & McCrae, 1986, Zhao & Seibert, 2006). According to Barrick and Mount (1991), this behavior trait is highly related to the work performance, as it refers to the way in which we control, regulate, and manage our impulse. Third, about extraversion, 29.19% of the analyzed users are individuals committed to the outside world, meaning they are joyful, very sociable people, who love to have fun and being in a permanent search for emotions and external stimulus (Costa, Busch, Zonderman & McCrae, 1986; McCrae & John, 1992 and Zhao & Seibert, 2006). However, 70.81% of the users are contemplative, which indicates that this group prefers to spend more time on their own, they are very reserved, calm and independent. Fourth, about kindness, 66.99% of the users are team players and confident, they are capable of forgiving, they are loving, altruistic and gullible, which represent people who are kind to others (Costa, Busch, Zonderman & McCrae, 1986; McCrae & John, 1992).

Also according to Apply Magic Sauce software, most visitors are men (75.60%). The X Generation (50.24%) is the most representing group, followed by Baby Boomers (29.67%). Both Generation X and Baby Boomers seek to learn and understand (cultural tourism), while the Millennials or Centennials seek adventure, fun, and entertainment. Baby Boomers get the highest score of leadership (63%), indicating that age can be a relevant factor to be a leader.

5 Conclusions

Based on the data above, it can be inferred that there is such a difference due to the interests and/or motivations of the traveler; that is, both Generation X and the Baby Boomers seek to learn and understand (cultural tourism), while the Millennials or Centennials seek adventure, fun, and entertainment, something they will obviously not find in the Archaeological Sanctuary of Pachacamac. Moreover, by analyzing the Big Five personality model, it was shown that Baby Boomers are the generation that stands out in most factors, that is, they are characterized as being liberal, artistic, creative, innovative, and imaginative (openness to experience); organized and hard-working people always look for achievement (conscientiousness); contemplative people, seek to spend time by themselves, they are reserved and calm (extraversion); people who seek teamwork, who are trustworthy, capable of forgiveness and altruistic (kindness); relaxed, confident, clam (neuroticism). Regarding the potential for leadership, once again, Baby Boomers get the higher score (63%), indicating that age can be a relevant factor to be a leader.

In addition, it should be noted that the image of the Archaeological Sanctuary of Pachacamac and the National Tourist Profile are highly related, since the results obtained through the frequently mentioned key terms reflect the generational characteristics of the Baby Boomers as predominant, followed by Generation X, all obtained by means of the Big Five personality model. In this sense, it is useful to analyze these two variables in the same study, as the results will allow for appropriate decision-making in the design of marketing strategies for each generation. We should also work on the positive projection of the image of the sanctuary since it has been observed that predominant groups have leading characteristics and their comments can be used as references for other visitors.

According to the consulted background, it should be taken into account that, at the international level, the methodology and model used in this research have been applied only to touristic destinations. However, at the national level it has been proven that it is possible to apply them to the study of the image of a tourist attraction, even with certain limitations. By means of this research, it was possible to

confirm that it is possible to apply them in an attraction's image study. Even if it is true that the Archeological Sanctuary of Pachacamac as such does not have restaurants nor accommodation as part of its touristic infrastructure, there are rural restaurants and haciendas in the district Pachacamac or Valle de Lurín that offer shows of Paso Horses and complement the visit very well.

6 References

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Predictive Modeling of Instagram User Engagement with tourist photos based on Visual Attributes: The case of Taquile Island – Peru

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Abstract

In the tourism sector, photography has evolved from capturing memories to becoming a tourism digital marketing strategy. The goal of this study is to identify the most important visual attributes that increase Instagram Engagement of the tourist destination Taquile Island (Peru). A predictive model that relates visual attributes and Engagement was developed using 439 photos of Taquile Island extracted from Instagram. These attributes were quantified using Image Analysis tools. Neural networks were used for the predictive model construction. This research shows that the most important visual attributes to increase the engagement on Instagram are lifestyle and natural landscape.

Keywords

Predictive model, engagement, neural networks, visual destination image, visual content analysis

1. Introduction

A tourist photo content has multiple visual attributes which are conditioned by the type of places visited. Although visual attributes can be relevant to predict the engagement of an image posted on Instagram, not all the attributes may be considered important (De et al. 2017) [1]. There are many qualitative-exploratory studies that focus on predicting reactions on Instagram; however, the quantitative approach that approximates the prediction of reactions using neural networks with a focus on tourism is scarce. Considering this information gap, the present study develops a predictive model that relates the engagement of tourist photographs and their visual attributes in the social network Instagram for the case of Taquile Island (Peru).

For this purpose, visual attributes of the photographs were quantified using Image Analysis Software APIs for the analysis of images, turning them into numerical data. Since engagement is a quantitative variable, neural networks were used. This study expands the knowledge about destination images regarding the most important visual attributes of user-generated content (UGC) on Instagram based on a rural destination in relation to the use of Instagram as a tourism promotion tool.

2. Literature Review

The perception of a tourist destination is not only related to information, but also transmitted through images; DMOs and DMCs use photos as part of their digital marketing strategy to promote tourist destinations. As a result, tourists build an image of the tourist destination in their brain (Millet, 2011) [2], therefore, image plays an important role in tourism (Diez & Crespo, 2020) [3] given that for tourists who have not visited the destination, it becomes a fundamental reference and a key factor when selecting a tourist destination which reflects what they expect to see at the tourist destination (Fakeye & Crompton, 1991) [4]. In the case of tourism, as there is no physical movement of products and services from where the offer is located to where the demand is found, an effective destination advertising that

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provides a good image and encourages the desire to visit the place is very important. Fatanti and Suyadnya (2015) [5] pointed out that Instagram has developed as a mean of tourist destination promotion that goes from being a tool for organizations to promote and position tourism destination brands around the world to spread user-generated content through tourist photos.

There are several attributes in a photo, not all of them can be described as indicators associated with tourism. Likewise, previous research in tourism has tried to categorize the visual attributes that are present in a photo (Fahmy et al. 2014) [6]. For example, in the Peruvian context, the visual attributes of a photo were studied by Stepchenkova and Zhan (2013) [7] in their work Visual destination images of Peru: Comparative content analysis of DMO and user-generated photography. These researchers identified ten visual attributes in the photos taken by travelers in the Peruvian territory: (1) natural landscape, (2) people, (3) archaeological sites, (4) life style, (5) traditional clothing, (6) architecture, (7) wild life, (8) adventure, (9) art object, (10) tourist facilities.

Predictive modeling is a process that consists in discovering relationships among data to predict some desired outcomes in the future using historical data (Mitchell, 2019) [8]. To do so, a set of predictors or relevant variables are used through the study of both present and historical data (Bhavya & Pillai, 2020). In the field of Data Science, a sector of the academy has embarked on building models that can predict the engagement of publications on social networks using different algorithms such as neural networks (De et al., 2017) [1]

2.1. Study Site

The Southern Route of Peru is one of the most demanded among foreign tourists for including the visit to Machupicchu. Lake Titicaca, the highest navigable lake in the world, is one of the most important attractions in this route (MINCETUR, 2020) [9].

Among the habitable islands in this lake lays Taquile Island, the object of study in this research, that has 3 essential elements: natural; cultural and human element; which allow to identify and quantify the largest number of visual attributes.

3 Materials and Methods

3.1. Population Sample

The population of this study consists of the total set of photos of Taquile Island on Instagram which exceeds 100,000 units. The type of sampling used was non-probabilistic for convenience. Inclusion criteria consisted of: (1) photos obtained using the geotag “Taquile Island-Puno” on Instagram; (2) clear and non-fragmented photos; (3) photos of public profiles due to Instagram’s privacy policy; (4) photos posted from May 2015 to September 2019; (5) photos of unique posts (with a single photograph). The sample size included 439 photos, being the most representative sample as compared to similar previous scientific research.

3.2 Construction of the Model

For the construction of the predictive model, 17 study variables from different research articles were defined, and different tools were used to measure such variables. These variables and their corresponding descriptions are shown in Table 1. Regarding the variable “likes”, Almgren, Lee, and Kim (2016) [10] found that likes can predict the future popularity of images on social networks. Also, the variable “awesome” was used by Deng and Li (2018) [11] to create a machine learning-based model to help DMOs at the moment of selecting photos. The importance of aesthetic characteristics of a destination is determinant in tourism literature as natural beauty plays a critical role in the destination choice process (Kirillova, Fu, Lehto, & Cai, 2014) [12]

Table 1.
Study variables

Variable	Type	Description	Reference
Engagement	Dependent	Likes+comments. (Engagement)	Zohourian et al. (2018) [13].
Followers	Independent	# of account followers	Chatzopoulou, Sheng, and Faloutsos, (2010) [14].
Hashtag	Independent	# of hashtags in the publication	
Number_days	Independent	# of days since publication on Instagram (collection data minus data of publication of the photo)	Data collection process
User_type	Independent and dichotomous	Shared by organizations (1) or by a person (0)	
Text_presence	Independent and dichotomous	Presence of text (1) or not (0)	Zhang, Chen, and Li (2009) [15].
Beauty	Independent	Beauty level (0 - 100%)	Scott, Le, Becken, and Connolly (2019) [16].; Kirillova, Fu, Lehto, and Cai (2014) [12].; Todd (2009) [17].
Awesome	Independent	Independent rating level as awesome (0 - 100%)	Deng and Li (2018) [11].
Natural_landscape	Independent	Presence of natural landscape. Values from 0	Stepchenkova and Zhan (2013) [7].
Traditional_clothing	Independent	Presence of traditional clothing. Values from 0	
Architecture	Independent	Presence of architecture. Values from 0	
Archaeological_sites	Independent	Presence of architecture. Values from 0	
Art_object	Independent	Presence of art object. Values from 0	
Life_style	Independent	Presence of scenarios associated with lifestyle. Values from 0	
Wild_life	Independent	Presence of wildlife. Values from 0	
People	Independent	Presence of people. Values from 0	
Adventure	Independent	Presence of adventure activities. Values from 0	
Tourist_facilities	Independent	Presence of tourist facilities. Values from 0	

- The following tools were used:
- Downloader for Instagram: Used to download Instagram photos in “.jpeg” format
- applying the inclusion criteria detailed in the point 3.1.

- Google Vision AI: Used to measure the 10 independent variables, proposed by Stepchenkova and Zhan (2013) [7]. Immediate results were obtained; JSON file was needed to visualize them completely.
- EyeEm Vision: Used to measure the variable “beauty”.
- Everypixel: Used to determine the level in which a photo can be qualified as “awesome”.
- SPSS Statistics: The steps followed for the modeling process of the white canvas were:(1)assigning a type (i.e., dependent or independent variable) in the data of origin (i.e., dataset) (2) dividing the data from the model of neural networks into training and testing data.

3.3 Data Collection and Analysis

Data collection involved a series of stages. Initially, photographs were obtained by applying the inclusion criteria explained in “Population and Sample”, using the geotag “Taquile Island-Puno” on Instagram. Then, data taken by direct observation was registered (e.g., date of publication, date of collection, followers, likes, comments, user type, presence of text, hashtags). Photos were downloaded using the Instagram Downloader application, and then they were stored for further analysis with the instruments of Image Analysis (i.e., Google Vision AI, EyeEm Vision and EveryPixel). This action was carried out in parallel with data recording. Next, data derived from direct observation and the results of the analysis with Image Analysis instruments explained in previous steps were consolidated into an SPSS spreadsheet. Finally, the SPSS Statistics software for automatic analysis of data was used, the consolidated dataset was imported, and the construction of the prediction model using Neural Networks was performed, and its accuracy was measured (SPSS output).

4 Results

The interrelationships between input nodes (predictor variables), hidden variables (10 of them in two hidden layers), and the output node (Engagement) are illustrated in Figure 1. The independent variables (i.e., visual attributes) were combined using two functions: hyperbolic tangent in the two hidden layers and identity in the output layer.

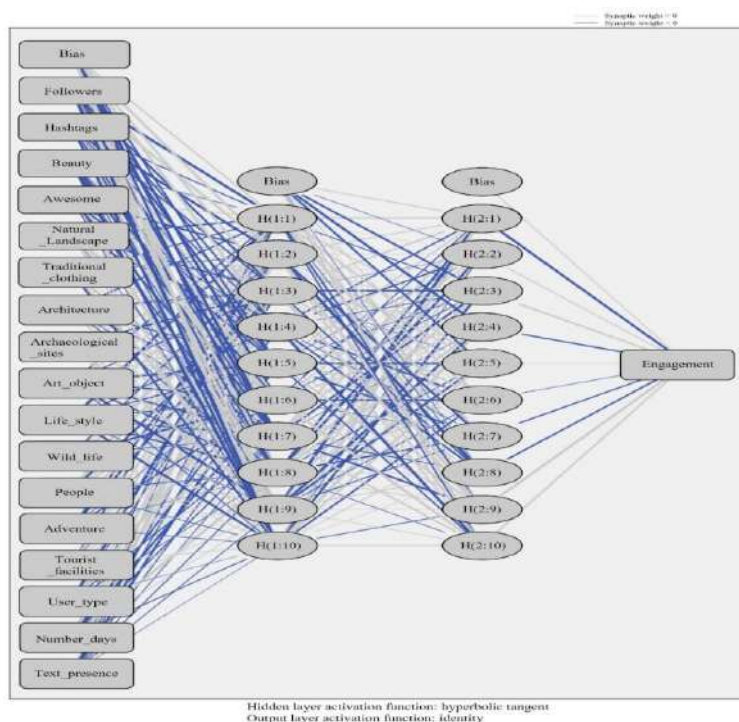


Fig. 1. Artificial neural network output diagram with insets for each layer. Output figure generated by IBM SPSS Statistics for Windows, Version 22.0. (Armonk, NY, USA)

The parameters of the neural network are also shown (Table 3). Regarding the general results of the neural networks model, it was observed that the model reached an accuracy of 70.20%. (Table 4)

Table 3.
Model Parameters

Predictor		Predicted							Engagement
		Hidden layer1							
		H(1:1)	H(1:2)	H(1:3)	H(1:4)	H(1:5)	H(1:6)	H(1:7)	
Input layer	(Bias)	-.435	.471	-.110	-.366	-.516	-.244	.113	
	Followers	-.156	-.301	-.613	.470	-.235	.767	-.292	
	Hashtags	.203	-.349	-.539	.055	.002	.091	.109	
	User_type	.401	.211	-.271	-.249	-.193	-.226	-.137	
	Text_presence	.219	.012	-.289	.201	.269	-.046	-.040	
	Number_days	-.180	.229	-.055	-.265	.393	.233	-.236	
	Beauty	.331	.248	-.225	-.307	-.438	.389	.079	
	Awesome	.113	.402	.095	-.436	.131	.137	-.275	
	natural_landscape	-.413	.316	-.567	.438	-.304	.085	.265	
	traditional_clothing	.421	.195	-.255	.297	.257	.033	.343	
	Architecture	.093	.627	.150	.173	-.274	.332	.353	
	archeological_sites	-.269	.588	-.215	.380	-.188	.030	.440	
	art_object	.345	.324	-.201	-.110	-.477	-.047	.119	
	life_style	.182	-.054	-.293	-.143	.576	.605	-.107	
	wild_life	.340	.012	.184	-.314	.043	.017	.181	
	People	.278	-.180	-.177	.202	.307	-.097	-.018	
Adventure	-.247	.340	.153	-.327	-.444	.174	-.147		
tourist_facilities	.430	.188	-.244	-.430	-.130	-.039	-.429		
Hidden layer 1	(Bias)							.177	
	H(1:1)							.014	

Table 4.
Summary of the Model based on a Neural Network

Partition	1_Training	2_Testing
Minimum error	-1.038	-0.73
Maximum error	1.358	1.323
Mean error	0.001	0.012
Mean absolute error	0.274	0.277
Standard deviation	0.356	0.343
Linear correlation	0.711	0.704
Occurrence	299.0	141.0
Accuracy	70.20%	

Figure 2 shows the importance of the predictor variable using Neural Network, the most important visual attributes to increase the engagement on Instagram are lifestyle and natural landscape.

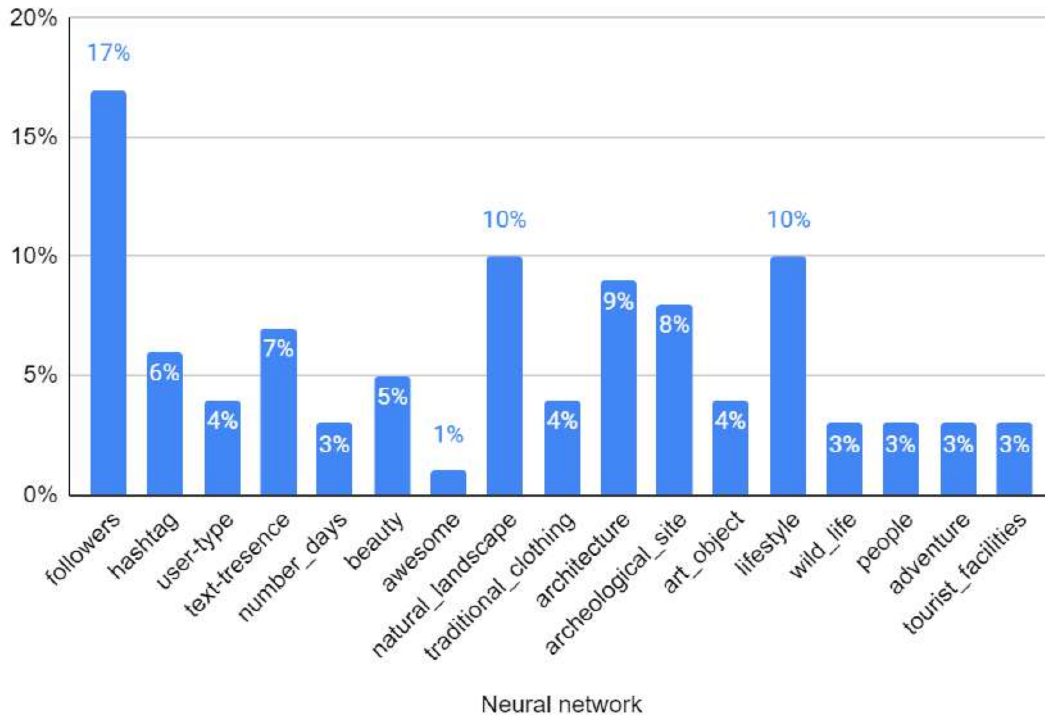


Fig. 2. Importance of the predictor variables using Neural Network. Source: Own elaboration with data from IBM SPSS Statistics for Windows, Version 22.0. (Armonk, NY, USA)

5 Discussion

This study offers several insights into the role of visual attributes present in a photo that enable predicting the Engagement on Instagram. Now we can find an enormous quantity of visual attributes present on a photo such as the presence of animals, persons, natural landscape and even the symmetry, balance, contrasts, colours and golden ratios of the photo are taken into consideration as visual attributes (Thömmes & Hübner, 2018) [18]. Nevertheless, not all of them are relevant to predict the engagement on Instagram (De, Maity, Goel, Shitole, & Bhattacharya, 2017) [1]. This study fills this gap in tourism literature, by building a ranking of the most important visual attributes present in a photo of a given tourist destination using neural network which allow DMCs, DMOs and tourism professionals to elaborate accurate online marketing strategies for tourism destinations on Instagram.

Visual destination images have been studied in different researches. However, Stepchenkova and Zhan's (2013) [7] were the only ones that compared the content-analysis of DMO and user-generated photographs taken in Peru. They considered that a photo can be fragmented in different visual attributes denominated as categories. In their study they identified ten main categories associated with photographs taken in Peru. These categories were identified as a point of reference for the methodology of this study, they were measured using different image analysis tools. Moreover, a ranking for the most and least important visual image attributes according to different mathematics techniques was elaborated.

When a photo is perceived as beautiful, it increases the number of likes and comments on Instagram posts (Colliander & Marder, 2018) [19]. In this study, we found out that the variable "beauty" has a direct relationship with the Engagement on Instagram. Moreover, Scott et al. (2017) [16] found in their research the importance of using beautiful photos in tourism marketing to capture tourist attention, using an eye-tracking software and the Likert-type scale surveys. For this study, the variable "beauty" was also measured using a specialized software but for image analysis, which means that traditional tools such Likert-type scale surveys - like the one used by Thömmes and Hübner (2018) [18] to measure the "beauty" of architectural photos - can be replaced with artificial software for image analyses which contributes to bias reduction or can be used as a complement tool.

Whereas, Deng and Lin (2018) [11] used the attribute "awesome" as a part of a machine learning model which enabled DMO to find the right photo for their marketing campaigns. They extracted emotional keywords

comments from UGC, 20,000 photos on Flickr to create this machine learning model. In contrast, in this study the attribute “awesome” was measured with the tool EveryPixel using instead of words, image analysis.

Moreover, Belk and Hsiu-yen Yeh (2011) [20] indicated that the level of human activity has a direct bearing on the fact that a photograph is captured. However, taking a photograph does not necessarily mean it will be shared on social media networks. This study suggests that in traditional and rural destinations like Taquile Island, when a photo shows human activity performed by the local population as a way to show their “lifestyle”, it generates better reactions (likes and comments) in social media networks.

Some attributes have a greater impact to predict the Engagement on Instagram than others. Ferwerda, Schedl, and Tkalcic (2015) [21], Bakhshi, Shamma, and Gilbert (2014) [22] and Araujo, Damilton Correa, Couto Da Silva, Prates, and Meira (2014) [23], all of them pointed out that the presence of people in a photo generates likes. On the other hand, the findings of this study revealed that the variable “people” is one of the least important to predict the Engagement on Instagram.

Finally, Hausmann et al. (2017) [24] collected geotagged photos from tourists on Instagram to find out what tourists would particularly like to see or experience when visiting a National Park. They agreed that tourists are interested in big animals and to experience nature through biodiversity-related activities. However, in this study it was found out that the variable “wildlife” is not meaningful to predict engagement on Instagram. This can be explained by the fact that travelers perceived Taquile Island as a rural tourism destination, whereas Kruger National Park stands out due to its large fauna

5.1 Conclusions

This research developed a predictive model which allows us to quantify the visual attributes of tourist destination photos, as well as to measure the level of Engagement on Instagram combining different visual attributes. Additionally, in the present research, the most important variables were “number of followers”, followed by “lifestyle” and “natural landscape”, which are the two most important visual image attributes to increase the engagement on Instagram. The variable that contributes least is “awesome”.

Finally, although the neural network model is more complex than other prediction models it did not present bias, and it registered a high accuracy (70.20%), which means that through the neural network model it is feasible to approach the prediction of engagement on Instagram from visual attributes.

5.2 Theoretical and Practical Implications

The present research makes a meaningful contribution to the tourism industry literature in relation to Instagram. First, this study expands the knowledge about destination images regarding the most important visual attributes of user-generator content (UGC) on Instagram based on a rural destination in relation to the use of Instagram as a tourism promotion tool. Moreover, this study can be considered as a point of reference for DMOs, DMCs, tourism marketing professionals or those who want to analyze photo records in tourism related research, taking advantage that UGC provides credible and easy-to-obtain data for tourism image research (Xiao, Fang, & Lin, 2020) [25] in a context where travelers themselves freely share photos of their trips on social media. Furthermore, it is useful for them in order to achieve cost-effective tourism promotions campaigns on Instagram and effective digital marketing KPIs. It provides insights for DMOs, DMCs and tourism marketing professionals to reduce resources, increase efficiency at the moment of choosing the right photo according to their needs, select the appropriate destination marketing strategies and increase the level of engagement on this social network. The competitiveness of the tourism destination increases with a right tourism image, which improves the satisfaction and loyalty of tourists (Kim & Stepchenkova, 2015) [26]. In fact, the methodology from this study can be replicated and/or adapted to other tourism destinations to determine which are the most important attributes based on the destination characteristics. Also, this methodology can be replicated in studies of exotic or urban destinations, in order to obtain other types of visual attributes different from those found on Taquile Island, as a rural destination. Additionally, although there are many studies based on visual content analysis in the field of tourism, this study is one of the first ones that measures the visual attributes of a photographics and its influence on Instagram Engagement. This study allows creating a new approach to tourism promotion using specialized software in a way that allows it to be a reference for future research and provide valuable insights for tourism professionals.

5.3 Limitations and Recommendations for future research

This study makes a significant contribution to tourism literature to understand the Engagement on Instagram, but it has some limitations. First, in the methodology of this study, a convenience sampling was used. This does not mean that the results lack validity, but it is necessary to clarify that the model is significant for the sample analyzed; and it is probably that they should have similarities with a population-based study.

Second, the instruments used (e.g., EyeEm Vision, Everypixel) were provided by third parties and are constantly being updated using algorithms based on the perceptions of professional photographers so what is considered beautiful or amazing may vary over time. Further, there are people who consider that computers' perception of meaning is far from the perception of the human brain. In photographs, not all the content is literal and an example of this are the "memes", which are representations with other meanings that differ from the literal one. In tourism, unstructured data such as the photos shared by tourists in their social media networks can be quantitatively studied with specialized software.

This study did not analyze posts in the "carousel" format, it was considered unique posts (a single photograph), due to the appreciation of users regarding the set of photos it is subjective. In that sense, metrics such as likes and comments are not precise. For instance, if a user gives a "like" this would not imply that they like all the photos in a carousel post. Also, it affects the SOR framework proposed by Mehrabian and Russell (1974) [27] by not being able to break down the photographs individually, and could not be able to identify and quantify their respective attributes that generated greater engagement (likes and comments). It should be noted that according to Duangkae (2018) [28] influencers prefer to publish single posts rather than carousel posts, because single posts obtain a higher average engagement rate. Moreover, Stine (2020) [29] and Duangkae (2018) [28] pointed out that the engagement generated by carousel posts goes against nature on Instagram. The reason is that carousel posts consist of many cards, whereby a user has to swipe right to left to see the other photos. However, Instagram users are accustomed to swipe up to view the next piece of content.

Finally, this study intends to explore the visual attributes of a photograph using instruments that can obtain image patterns, which can hopefully lead to expand this topic in future research, since there are few similar academic studies related to the tourism sector. Thus, it is recommended to continue using these tools as well as to replicate the model in other destinations comparable to Taquile Island in order to identify differences and similarities in the modeling. It is also suggested to keep a record of the observed and predicted values and to adjust the indicators of the model in order to update its parameters, since preferences may vary over time. The photographic content is the greatest determinant of engagement; however, in case that two photos have a similar content, the publication of the one that has more aesthetics or has the capacity to cause amazement is recommended. This can be controlled with elements such as effects and color balance, among others. Moreover, this research can be complemented with qualitative studies with the aim of comparing similarities and differences. Also, for future research, there is the possibility of building models in which travelers are segmented according to personal characteristics (e.g., gender, national or foreign origin, etc.).

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COVID-19 PREVENTIVE MEASURES AMONG ARTISAN WOMEN WORKING WITH NATIVE COTTON IN A PROTECTED NATURAL AREA

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Abstract

The COVID-19 pandemic has significantly affected the tourism sector globally. In recent years, tourism in Peru experienced sustained growth, and the natural protected areas (ANP Areas Naturales Protegidas) became consolidated into main tourist destinations. Nevertheless, vulnerable groups like artisan workers have suffered more acutely from this crisis. This study was conducted in the buffer zone of the Bosque de Pómac Historic Sanctuary, with the study population being the artisan women of the native cotton weaving line (of the scientific name of *Gossypium barbadense* L., a trade product native to the area, which is in the process of extinction and was used by ancestral cultures). The objective of this study is to describe the socio-demographic profile and the compliance with preventive measures against COVID-19 of artisan women for tourism recovery. The research has a quantitative, descriptive-cross-sectional approach. A checklist was given to 30 artisan women specifically from the Jotora-Jayanca, Pómac III-Pitipo, and Túcume population centers. To test the content validity of the instrument, Aiken's validity coefficient was chosen with 10 assessors who were experts in health and tourism; the items were fully approved and statistically significant (Aiken's $V = 1$, $p = 0.001$). The data was processed with IBM SPSS version 25, using descriptive statistical techniques. The results showed that 93.3% of the artisans had their vaccination doses and 70% are still not complying with preventive measures such as hand washing, the use of masks, and social distancing required by COVID-19 on behalf of the Peruvian state. It is concluded that interventions are needed to apply protocols when tourism has recovered for personal, family, and community care.

Keywords

Preventive measures, COVID-19, artisan work, native cotton, tourism reactivation, protected natural area.

1. Introduction

The incipient tourist activity during this COVID-19 pandemic is a cause for alarm, as it affects the most vulnerable groups whose only means of subsistence is the use of the landscape resource or the sale of their products/services to visitors (Esparza et al. 2020). In Peru, the Ministry of Foreign Trade and Tourism (2021a), has been promoting measures to revive craftsmanship, one of the sectors hardest hit by the COVID-19 pandemic, throughout the country. Artisan work plays an important role in the

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con-text of the national economy, as it involves diverse indigenous peoples and important groups of women and is a highly inclusive activity.

Women artisans who work with native cotton are a vulnerable group because they live in the poor rural areas of the Department of Lambayeque, such as Jotora –Jayanca, Pómac III-Pacora, and Túcume. The native cotton, whose scientific name is *Gossypium barbadense* L., is in a period of extinction. It was used by the ancestors of the Moche culture, and it has also been considered the Ethnic-Cultural Genetic Heritage of the Nation and the flagship product of Lambayeque due to its use as a raw material for the production of fabrics (Runcio & Espinoza, 2019). The economic activities of artisan women revolve around the manufacture of artisan work, domestic activities, and work in the field; all these tasks are complemented for the maintenance of the household. But they do not manage to surmount the minimum income, despite various government-funded projects and international cooperation which have sought to strengthen this activity. The production characteristics still show inefficiencies; the number of hours taken to produce an article is high and the price does not compensate for the time that the artisans dedicate to it. Whereas the commercialization of the products is weak, there are no busy points of sale and the volume of sales is not significant (Fustamante, 2013). Nevertheless, it is of high interest to them that these ancestral practices are not lost and that is why they have not yet abandoned them.

Amid the health crisis and epidemiological peaks of the COVID-19 pandemic, the artisan women are hoping to sell their products again as they have access to tourists. But to revive tourism in the area, they must get to know and apply the biosecurity protocols for COVID-19 that are imposed by the Peruvian government, to restore confidence among visitors. However, the practical knowledge of preventive measures such as proper use of masks, proper hand washing, and social distancing are lacking, which delays the revival of tourism since tourists are demanding compliance with COVID-19 protocols.

In a study in Nigeria, participating artisans demonstrated their knowledge of public health advice to control COVID-19, such as maintaining social distancing, wearing face masks in public spaces, and complying with personal hygiene measures. However, it was revealed that they sought alternative 'perceived' public health measures that their financial situation could accommodate, and they violated strict lockdown regulations introduced by the government due to the inherent financial rewards of going to their workplaces (Lawal et al. 2022). The protocols highlight the measures aimed at maintaining social distancing; enhancing hand hygiene, cleanliness, and safety practices, and 'monitoring' the health of participants in tourism activities. The emphasis on health and the implementation of preventive measures can have a significant impact on the relationships and spatial-temporal dimensions of the tourism experience, which are important factors to take into consideration (Catalano & Tapia, 2020).

Therefore, more public information is needed to bridge the gap between policy and practice so that everyone linked to tourism activities is adequately informed about the necessary precautionary measures mandatory for them about the COVID-19 pandemic (Okueso, Buraimo, & Adekoya, 2020). Reflecting and taking into consideration the characteristics of the preventive measures against COVID-19, it is possible to distinguish the potentialities and limitations of the tourism experience whilst implementing them and these aspects are significant enough to be studied (Catalano & Tapia, 2020).

In this sense, a scenario of the gradual recovery of the tourism sector based on uncertainty is forecast, dependent on several factors such as the capacity to generate policies for the practice of safety protocols to confront COVID-19, in addition to the new behaviors of the post-pandemic tourist, which will set the tone for the territories' recovery. For this reason, all sectors should generate changes and start afresh, tourism stakeholders should prepare for recovery based on the application and effectiveness of public health and economic measures (Velandia, 2020).

The purpose of this study is to describe the socio-demographic profile and compliance with COVID-19 preventive measures among artisan women of the native cotton weaving line for tourism recovery in the area surrounding the Bosque de Pómac Historic Sanctuary.

2. Materials and Methods

The research has a quantitative, descriptive-cross-sectional approach. The population and sample consisted of 30 female artisans specifically from the towns of Jotora-Jayanca, Pómac III-Pitipo, and Túcume, who met the inclusion criteria of legal age, artisan working in the native cotton line, and giving their informed consent to participate in the study.

To collect data, the observation technique was applied using a ‘COVID-19 prevention’ checklist. The instrument was prepared based on the instructions on COVID-19 health measures for artisan workshops and points of sale prepared by the Ministry of Foreign Trade and Tourism (2021b) and consists of two sections: the first collects overall information on the artisan women (questions on age, marital status, educational level, family income, number of members in the household and COVID-19 vaccination status); the second refers to compliance with the ‘COVID-19 prevention’ checklist containing two-dimensional yes or no response items on general preventive measures, before and during the activity of the artisan production process and after the sale of artisan work in the workshop, stall or artisan store.

To test the content validity of the instrument, Aiken's validity coefficient was chosen, including 10 expert judges in health and tourism, seven doctorates and 3 had master's degree holders, 6 professional nurses, and 4 from the tourism sector; most of them were also university professors and carry out research related to the subject being studied. Each one made an evaluation of the items by scoring Yes = 1 point or No = 0 points, out of which seven items were completely approved and statistically significant (Aiken's $V = 1$, $p = 0.001$). Furthermore, items 1 and 5 were predominantly and statistically significant (Aiken's $V = 0.9$, $p = 0.001$). Therefore, all nine items were valid. The data are presented in tables and IBM SPSS version 25 was used to show compliance with the COVID-19 preventive measures in the artisan women.

3. Results

The main findings of the fieldwork are defined below in a differentiated manner according to the blocks addressed. Firstly, the results of the descriptive analysis of the socio-demographic profile of the artisans of the native cotton weaving line living in the buffer zone of the Bosque de Pómac Historic Sanctuary are shown (see Table 1). Secondly, compliance with the preventive measures of COVID-19 in the artisans is identified and finally, compliance with the preventive measures of COVID-19 in the production and sale process of their artisan work is recognized.

About the descriptive results of the socio-demographic profile of the artisan women shown in Table 1, it is observed that the predominant age group is women aged 51 years and older, which represents 50% of the population, followed by artisans aged 41 to 50 years (20%) and artisans aged between 20 to 30 years is the least representative (13.3%). Only 26.6% have completed their studies (primary and secondary), and the number of family members is 2 to 3 people, which represents 43.3%. Also, 90% of the artisan women indicate that their income from the sale of artisan work is less than the minimum living wage (SMV: Salario Mínimo Vital), which in Peru is 1025.00 soles.

Table 1
Socio-demographic profile of residents

SOCIODEMOGRAPHIC VARIABLES		N°	%
Age	20–30 years	4	13.3
	31–40 years old	5	16.7
	41–50 years	6	20.0

	51 and over	15	50.0
Marital Status	Single	8	26.7
	Married	9	30.0
	Cohabiting	9	30.0
	Divorced	3	10.0
	Widowed	1	3.3
Grade of Education	No education	2	6.7
	Completed elementary school	4	13.3
	Incomplete Elementary	8	26.7
	High school completed	8	26.7
	Incomplete High school	4	13.3
	Superior - Technical	4	13.3
Number of family members	2–3 members	13	43.3
	4–5 members	11	36.7
	6 or more members	6	20.0
Income from Crafts	< SMV	27	90.0
	= SMV	2	6.7
	> SMV	1	3.3

It was evaluated whether the artisan women are complying with the general pre-ventive measures imposed by the Peruvian state, which are as follows: carrying out clean-ing and disinfecting process on surroundings, furniture, tools, and equipment among other inert surfaces to ensure they are free of COVID-19; ensuring the quanti-ty and lo-cation of hand washing points (water, liquid soap or gel) and alcohol for the artisan's use; implementing the correct use of double surgical masks or a KN 95 and respecting the social distance of at least 1 meter.

The results obtained show that 93.3% of artisan women have been vaccinated against COVID-19, which is the most effective prevention measure worldwide (see Table 2).

In terms of compliance with the general preventive measures, 70% of the artisan women do not comply or are at a beginner level with the health protocols and 30% of the artisan women are in the process, meaning that in some cases they use alcohol when in contact with another person, they clean and disinfect their work tools and use a surgical mask.

Table 2
General preventive measures

HEALTH SITUATION-COVID 19		N°	%
COVID 19 Vaccine	Yes	28	93.3
	No	2	6.7
Level of Compliance with General Preventive Measures	Non-compliant/ Beginning	21	70.0
	In Process	9	30.0
	Total	30	100.0

Concerning compliance with COVID-19 preventive measures in the production pro-cess and the sale of artisan work, three stages have been identified: Before the activity–artisan work production process (stage 1); at the sale of artisan work in workshops, stalls, or artisan stores (stage 2) and after the artisan activity (stage 3), as shown in Table 3.

In compliance with stage 1, 70% of the artisan women do not comply or are in the pro-cess of beginning to comply with the preventive measures, with the lowest indicators being when more than two artisans meet to produce their work, they do not keep social distance and do not use double surgical masks or a KN 95 with 80% and 83.3%, respectively.

Concerning compliance with stage 2—regarding the sale of artisan work in the work-shop, stall, or store—100% of the artisan women do not comply with the prevention measures, for tourism revival and are not prepared to serve the public. Only 16.7% of the artisan women have installed or use a hand sanitizing point at the entrance of the workshop, stall, or store. A hand disinfection point has been installed or used at the entrance of the workshop, stall, or craft store by 7% of artisan women; only

3.3% use electronic payment methods or digital wallets as most of them are afraid of electronic transactions and 100% have not placed signs that promote care and measures to pre-vent COVID 19.

In compliance with stage 3, 76.7% of the artisan women do not comply or are in the process of beginning to comply with the preventive measures after carrying out their activities; only 23.3% store raw materials and consumables in the storage area, discard the containers (bags, paper, etc.) and disinfect the area; 83.3% of the artisan women wash and disinfect their hands at the end of the operation.

Table 3

Preventive measures in the production and sales process.

PREVENTIVE MEASURES IN THE PRODUCTION AND SALES PROCESS					COMPLIANCE					
QUESTIONS	Frequency	Percentage	Non-Compliant / Beginning		In Process		Compliance / Achieved			
			N°	%	N°	%	N°	%		
Stage 1	Cleaning and disinfection of raw materials, supplies, tools, and equipment at the beginning of the workday.	Yes	10	33.3						
		No	20	66.7						
		Total	30	100						
	Washing and disinfection of hands when starting the production of their work.	Yes	12	40						
		No	18	60						
		Total	30	100						
	When more than two craftswomen come together to produce their work, they ensure social distancing (1 meter).	Yes	6	20	21	70	4	13.3	5	16.7
		No	24	80						
		Total	30	100						
	When more than two craftswomen come together to produce their products, they use double surgical masks or a KN 95.	Yes	5	16.7						
		No	25	83.3						
		Total	30	100						
Stage 2	Install and use a hand sanitizing station at the entrance of the workshop, booth, or artisan store.	Yes	5	16.7						
		No	25	83.3						
		Total	30	100						
	Places signage to promote social distancing at the point of sale	No	30	100	30	100	0	0	0	0
		Yes	1	3.3						
	Use electronic means of payment or a digital wallet for transactions.	No	29	96.7						
Total		30	100							
Stage 3	Store raw materials and supplies in the storage area, discard packaging (bags, paper, etc.), and disinfect.	Yes	7	23.3						
		No	23	76.7						
		Total	30	100						
	At the end of the operation, hands are washed and disinfected.	Yes	5	16.7	23	76.7	2	6.7	5	16.7
		No	25	83.3						
Total	30	100								

4. Discussion

In this paper, regarding the socio-demographic profile of the artisan women in the native cotton weaving line living in the area surrounding the Bosque de Pómac Historic Sanctuary, half of them were 51 years of age or older while the least representative age group was between 20 and 30 years of age. The number of women who have completed primary and secondary school is a little over a quarter. These results may be because, in the past, families gave priority to boys for basic education and since they lived in rural areas, educational centers were far away, and the art of artisan work was passed on to their daughters. However, nowadays it can be observed that the sons and daughters of the artisan women dedicate themselves to developing other activities to improve their economic status. Even though this is commendable, when analyzed from the point of view of cultural legacy, it puts the transference of this ancestral knowledge at risk.

In addition, almost all of the artisan women testify that their income from the sale of their work is less than the SMV, which in Peru is 1025.00 soles, equivalent to 262.82 US dollars. Along with the COVID-19 pandemic, this income was nil or very low for their family's subsistence. However, most of the artisans live with their spouses, either married or cohabiting. In these areas, they dedicate themselves to family agriculture; this economic activity supported them during the pandemic and these families subsisted on what they produced in the fields. The closure of tourist activities affected the artisan women because they stopped producing and selling their products, which did not allow them to have an income for their households. According to, Shafi, Liu & Wenju (2020), they point out that the situation is similar to most of the craftswomen in Pakistan, as they have been severely affected and face several problems such as financial disruption of the supply chain, decrease in demand, and the reduction of sales and profits, among others. Moreover, most of them were not prepared, nor did they have any plan to handle such a situation. This is corroborated by Gavilanez (2021), who concludes that the artisanal trade faced challenges in the delivery and the direct sale of their products, unemployment, a reduction in orders, and poor acquisition of raw materials and exports which limited their economic income immeasurably. Another impact related to tourism was the decrease in the production and sale of tourism products such as artisan work. For the commercialization of products, there could be a rapprochement between the artisan and the client through social networks and the media (Santa-Cruz et al., 2021).

For this reason, the Ministry of Foreign Trade and Tourism (2021a) recognizes that artisan work plays an important role in Peru's economy as it involves various indigenous people and an important group of women. A series of measures are being considered to reactivate artisan work throughout the country, as it is one of the sectors most affected by the COVID-19 pandemic, such as capacity building, innovation, formalization, commercial articulation, and promotion. The 'Somos Artesanía' program aims to provide liquidity to artisan units and promote their economic recovery within the context of COVID-19 with a budget of S/. 2,500,000.00 by 2022, which would allow the co-financing of approximately 333 projects nationwide (1,660 artisans). Some of the artisan women who participated in the study have accessed this financial help with non-reimbursable competitive funds from the state to help reactivate their businesses and artisan activities during this health crisis.

Conversely, almost all the artisan women have been fully vaccinated. Most artisans have been vaccinated because it is a requirement by the Peruvian government for the reactivation or reopening of tourism activities, and the study was conducted in the context of the end of the third wave.

Contrary to the study by Wang, et al. (2021), reluctance to vaccinate is one of the main threats to the effectiveness of vaccination programs. The willingness to accept the COVID-19 vaccine among participants was lower in the third wave (34.8%) than in the first wave (44.2%). There were more

concerns about vaccine safety in the third wave. Service or sales workers were less likely to accept the vaccine. This decreasing trend could also be the result of a high level of concern about vaccine safety. Future promotion of vaccination should address these concerns, and an adequately and comprehensively tested vaccine would help gain public confidence.

However, in terms of compliance with general preventive measures, most of the artisans are not complying with those such as hand washing, use of masks, and social distancing, which are the preventive measures required by the Peruvian state. This may be because deaths from COVID-19 have decreased during the third wave and hence, there needs to be more awareness using health education from health workers.

The results contrasted with the study by Wang, et al. (2021), who reported in China a high level of compliance with facemask use and more people maintaining social distancing and using alcohol hand sanitizer in the third wave. In the United Kingdom, almost all respondents reported taking at least one preventive measure: 85.8% washed their hands with soap more frequently, 56.5% avoided crowded areas and 54.5% avoided social events (Atchison et al., 2021). Meanwhile, Fernandez-Guzman et al. (2021), indicate that less than half of the Peruvian participants performed prevention and control practices against COVID-19. However, the use of masks when leaving home, covering the nose and mouth when sneezing or coughing, keeping a distance from others in the street, washing hands with soap and water when returning home, and disinfecting surfaces of objects and personal places were the most frequently performed preventive measures.

Along with social distancing, hand cleaning, and other preventive measures, the use of facemasks is considered to be another scientific approach to the prevention of this coronavirus. Thus, the use of facemasks is mandatory worldwide as part of personal protection and public health measures to curb the rapid transmission of corona-virus disease (Rahman et al., 2022).

Another aspect addressed in this study is compliance with the protocols or preventive measures of COVID-19 in the production process and sale of artisan work. In terms of compliance with preventive measures during the artisan production process (stage 1), most of the artisan women do not comply with or are in the process of initiating the protocols; the lowest indicator is when more than two artisans meet to produce their artisan work, they do not keep a social distance and do not use a double surgical mask or a KN 95.

These results are similar to the study by Okueso, Buraimo & Adekoya (2020), where they conclude that market workers in Ogun State had a low level of adherence to the COVID-19 protocol. Based on this, it is recommended that health professionals should be more involved in disseminating information on how to curb the further spread of COVID-19 in these vulnerable sectors. According to Lawal, Kareem & Adebayo (2022), artisans in Nigeria demonstrated knowledge of public health advice in the control of COVID-19 such as maintaining social distancing, wearing face masks in public spaces, and complying with personal hygiene measures.

Concerning compliance during the sale of artisan work in the workshop, stall, or store (stage 2), almost all the artisan women do not comply with the prevention measures. Less than a quarter of the artisans have installed or use a hand disinfection point at the entrance to the workshop, stall, or store. Moreover, very few artisan women use electronic means of payment, perhaps because they are afraid of electronic transactions. For Catalano & Tapia (2020), the use of technology appears as an advantageous tool that facilitates distancing. Such a tool allows, at the same time, to favor and anticipate access to information as well as the management of certain activities that had been implemented mostly in person until now; i.e. for example, obtaining reservations, requesting payment, or performing pre-check-ins or pre-check-outs through digital applications or websites is proposed.

Guha, Mandal & Kujur (2021) showed that their artisan products had a very strong impact on creating awareness and a brand image in the social media environment on various platforms to promote their products in India and beyond, and will confer brand recognition among other industrial competitive brands which will consequently lead to an increased demand for these products. Peruvian

handicrafts are diverse; the main difficulties in the artisan sector are related to the scarce diffusion and lack of knowledge of the artisan lines and sub-lines. Thus, Peruvian artisan companies can expand in e-commerce, innovation, and ICT and this can make these companies more competitive. In addition, digital marketing is a great tool that allows products and services to be promoted on the network (Santa-Cruz et al. 2021).

The challenges faced by women artisans are many; it is known that, often, due to their precarious economy, they are not aware of digital media and cannot make their work known in places other than fairs and stores. This is a fact that worries them because amid the COVID-19 pandemic, fairs are no longer held and stores cannot always remain open (Pinheiro, 2021).

This may be due to lack of knowledge, low income, and the fact that they are in the process of reactivating tourism, which suggests that the artisans are not prepared to serve the public and run the risk of acquiring or spreading COVID-19.

In addition, most of the artisans do not comply or are in the process of beginning to comply with the preventive measures after carrying out the artisanal activity (stage 3). Less than a quarter of the artisan women keep raw materials and consumables in the storage area, discard containers and disinfect the area. However, most women artisans wash and disinfect their hands at the end of the operation. It is also common to use medicinal alcohol to disinfect hands and materials used. In essence, there is a need to create more awareness of the COVID-19 pandemic among this group of people. This can be done through radio, television, or even organized talks within the community or at the local government level in an effort toward better information on this deadly virus (Okueso, Buraimo, &, Adekoya, 2020).

Among the limitations of the study, the sampling was non-probabilistic by convenience and the sample is small; it focused only on native cotton artisans, so the data cannot be standardized. Another limitation was at the time of collecting the data and observing there may have been an underestimation of the information.

5. Conclusions

As most of the artisan women working with native cotton are over 50 years old and very few young people are involved, this cultural legacy could be lost. However, they have survived in the area where they live because, in addition to artisan work, they work in family farming. In addition, 93.3% of the artisan women have had their vaccination doses and 70% are still not complying with the preventive measures required by COVID-19 by the Peruvian government, such as hand washing, use of masks, and social distancing.

This is due to overconfidence that they are vaccinated because there were not so many deaths in the third wave, and in addition, the familiarity among the artisan women due to the proximity to where they live. Therefore, interventions to apply protocols for personal, family, and community care are recommended to revive tourist activity.

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Structural equations method for the analysis of the quality of service in the hotel industry

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Abstract

This article examines the quality of service experienced at the Sonesta Loja hotel in Ecuador. We calculated an overall guest satisfaction index using a model consisting of four constructs and four hypothesized relationships that are tested through the Structural Equation Method using ADANCO software. Data were obtained from a survey applied to a sample of 334 guests between March 2019 and March 2020. The results show that tangible and intangible elements have a high significance on the perceived value, and this, on the level of satisfaction. Lodging facility managers can use the findings to identify meaningful attributes to guests, allowing them to redirect and provide specific guidelines to increase perceived quality. Loja hotel industry can use the results to improve the competitiveness of the accommodation sector and establish specific service marketing strategies.

Keywords

service quality, intangible elements, tangible elements, level of satisfaction, perceived value, and small and medium-sized enterprises.

1. Introduction

This article focuses on one of the tourism service industries that has seen the most significant development in recent years: the lodging industry. This fact has generated the need to integrate tools that make it possible to determine the factors and criteria users consider when evaluating the quality of service. The purpose is to obtain indicators contributing to the design and management of competitive strategies [1], [2].

The services sector has played an essential role in countries' economies worldwide. It currently generates more than two-thirds of the world's gross domestic product -GDP- and is the primary source of employment [3], [4]. Therefore, the economy is focused on service activities, unlike in the past, when the economy was centered on goods-producing companies [5]. These changes have led to the growth of the offer with an increasing number of companies. However, one of its primary needs is incorporating quality management tools with a vision oriented to customer satisfaction.

Services are considered intangible economic activities, so the generation of value is associated with immediate consumer sensations [6], [7]. Today's customers are more demanding and critically value the factors that meet their needs. These factors may come not only from your perception but may also be motivated by other people [8], [9]. In addition, external factors (social, political, cultural, and technological) influence the purchase decision.

Companies must determine the tangible and intangible factors that affect their customers' perception of service quality, image, and reputation [10], [1]. Consequently, they must adopt new marketing strategies focused on innovation to meet current and future customer needs to be based on market analysis, consumer behavior, and trends.

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The services sector includes tourism companies, which are considered one of the activities with solid growth potential. In Ecuador, according to the Ministry of Tourism, in 2019, the contribution of tourism companies to GDP was 2.1%. In this context, accommodation and food and beverage service companies generated 477 382 jobs, representing 6.1% of total employment. Those data highlight the opportunity to create new local enterprises in the services area.

Recent research has evaluated the effects of service quality that directly and indirectly affect hotel customer loyalty and purchase intent [11]. The results obtained through surveys and applied analysis techniques showed the correlation between service quality and loyalty in purchase intention. This means that the service quality and loyalty variables have a significant influence as determining factors in purchase intention. Moreover, quality has a more significant impact on purchase intention. Therefore, hotel owners must provide quality service to impact consumer loyalty directly and sustain purchase intent. [12] oriented his research to evaluate the experience of tourists through satisfaction with the services received. He correlated satisfaction with other variables by applying structural equations to the data collected, obtaining important information about the offer and quality of the services provided. For example, the survey allowed analyzing factors related to expectation, quality, satisfaction, value, complaint handling, and tourist loyalty. The results showed a significant relationship between quality, value, and consumer satisfaction. Also, the results evidenced a high and positive relationship between customer satisfaction and loyalty.

This study contributes to the literature on consumer behavior and the theoretical and empirical evidence on evaluating service quality in lodging establishments. For this purpose, the paper is structured as follows: first, the research question and hypotheses are established; second, we develop the methodology used and the sampling characteristics. Finally, the results, discussion, and conclusions are proposed.

1.1. Research question and hypothesis

Based on the literature review conducted, the research questions are aimed at determining the influence that tangible and intangible elements of the establishment have on the perceived value of guests and the extent to which perceived value affects the level of satisfaction. For this purpose, we have developed the following hypotheses:

- H1: There is a positive relationship between tangible elements and perceived value.
- H2: There is a positive relationship between intangible elements and perceived value.
- H3: There is a positive relationship between perceived value and satisfaction level.
- H4: There is a positive relationship between tangible elements and the level of satisfaction.

2. Methodology

2.1. Population and sample

The study population is composed of the guests of the Sonesta Loja hotel. This establishment is in the city of Loja, in southern Ecuador, has a five-star category, and is operated by the company Grupo Hotelera Londoño (GHL). This company operates its brands and international franchises in 13 Latin American countries. Currently, GHL operates 72 hotels that share the same service standards.

The data comes from a survey of 735 guests from March 2019 to March 2020. In the initial verification process, it was observed that there were sections that the respondents had not answered. In this regard, to ensure the availability of representative and complete information, the following inclusion criteria were considered: i.) surveys during the period March 2019 - March 2020, ii.) all the questions that make up the different sections or blocks were answered, and iii.) surveys conducted through the REVINATE system. In summary, the sample consisted of 334 observations that met the inclusion criteria.

2.2. Instruments

The questionnaire application is one of the techniques of most outstanding contribution. In this case, it was applied online through the REVINATE system that collects the guest's opinion once their stay is over. The system sends an e-mail to each client with the survey and a statement of reasons, highlighting the importance of filling it out. Once answered, the guest's opinion is received, stored, and tabulated. This process facilitates descriptive statistical analysis. The Quality Manager coordinates its use within the company.

The researchers managed the authorization to have access to the REVINATE reports. The data are compatible with EXCEL spreadsheets, through which we proceeded to reorganize the variables to adapt them to the structure required by the proposed model. The questionnaire consists of 50 questions grouped into ten blocks, including four sociodemographic questions.

2.3. Analysis method

As a result of an exhaustive review of the existing tourism literature, 46 variables were grouped into four constructs (dimensions) to form the structural equation model (SEM): tangible elements, intangible elements, perceived value, and satisfaction. Following [13] 's proposal, an SEM was formulated using ADANCO software to test the hypotheses. According to [14], SEM tests for causal paths between latent variables and measures the collective strength of a set of variables. The path analysis through mediation assumes that one or some variables can influence an outcome directly and indirectly through another variable [15]. According to our hypotheses, Figure 1 shows a model where TE and IE influence directly to PV and indirectly influence SL through PV; also, TE could affect directly to SL.

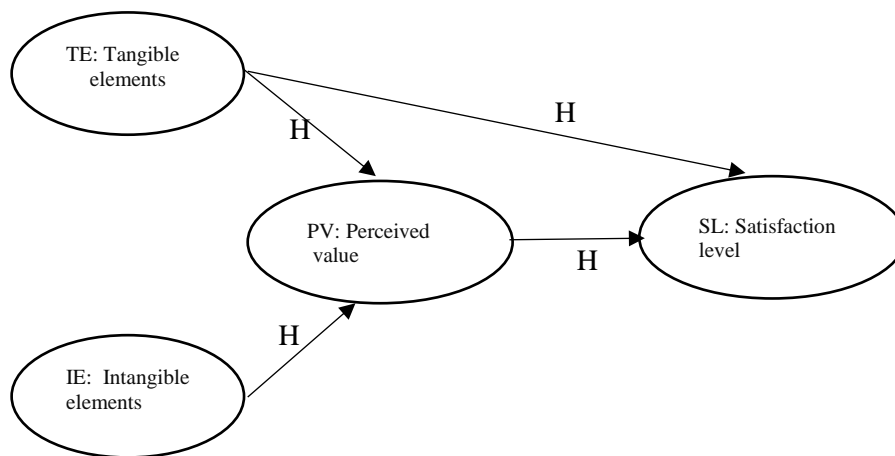


Figure 1: A proposed theoretical model

Following the procedure, the stability and consistency of the model variables were evaluated using ADANCO software. Finally, through the same ADANCO, the final analysis is carried out using the Structural Equations Method (SEM), which assesses the interrelationships of the variables and tests the proposed hypotheses.

3. Analysis and results

3.1. Reliability analysis

Reliability analysis evaluates the consistency of the variables measured in each construct. For this, a standardized loading on each variable greater than 0.707 is recommended [16], [17], [18]. However,

we decided to include only those variables with a Cronbach's alpha >0.6, following the recommendations of some researchers who point out that, for studies in initial phases, a value of 0.600 is sufficient [19], [20], [21]. In addition, variables are essential to retaining construct validity [22]. Our results have values between 0.649 and 0.828 which shows acceptable construct reliability (See Table 1).

Table 1
Scale reliability of the dependent and independent variables.

Independents Variables		Charge
<i>TE</i>	<i>Perceived quality in tangible elements</i>	
CTE5	Condition of room furnishings	0.775
CTE6	Condition and comfort of the room's bathroom	0.676
CTE7	Room maintenance (floor and walls)	0.772
CTE8	Comfort of the bed	0.727
CTE9	Ease of working in the room	0.719
CTE10	Room cleanliness	0.784
CTE11	Room tidiness on time	0.692
CTE12	Bed arrangement	0.769
CTE13	Maid presentation	0.733
CTE14	Bathroom cleanliness	0.753
<i>IE</i>	<i>Perceived quality in intangible elements</i>	
CIE4	Greeting and friendliness of the reception staff at the time of check-in	0.684
CIE5	Waiting time at the reception desk for registration	0.769
CIE6	Speed of check-in process at the front desk	0.649
CIE18	Waiting time at the check-out counter for the check-out process	0.745
CIE19	Speed of check-out process at the front desk	0.751
CIE20	Assistance with departure requests	0.724
CIE21	Greeting and friendliness of front desk staff at check-out time	0.748
Dependent Variables		
<i>PV</i>	<i>Perceived value</i>	
PV1	Value	0.711
PV3	Employee responsiveness to your needs	0.801
PV5	Check-in/registration experience	0.766
PV9	Experience with check-out	0.728
<i>SL</i>	<i>Level of satisfaction</i>	
SL2	Cleanliness of the facility	0.747
SL4	Rooms in the establishment	0.778
SL5	Service	0.828
SL6	Quality of rest	0.812

Note. All questions were averaged on a Likert scale of 1-10, with 1 being "Completely dissatisfied" and 10 being "Completely satisfied".

3.2. Measurement of model

The model proposed by the research hypothesizes the existence of four significant causal relationships between four dimensions, namely, i.) tangible elements, ii.) intangible elements, iii.) perceived value, and iv.) level of satisfaction.

The consistency of the constructs that make up this model was determined through the reliability process. This process was done from an analysis of the level of significance and reliability, taking into consideration Dijkstra-Henseler's rho (ρ_A), Jöreskog's rho (ρ_c) and Cronbach's alpha(α), as shown in Table 2.

Table 2
Significance of model constructs and reliability results.

Construct	Dijkstra-Henseler's rho (ρ_A)	Jöreskog's rho (ρ_c)	Cronbach's alpha(α)
IE	0.8566	0.8857	0.8506
PV	0.7478	0.8388	0.7444
SL	0.8125	0.8707	0.8029
TE	0.9131	0.9239	0.9085

The results in Table 2 show acceptable consistency and reliability. Most of the indicators are more significant than 0.8, except the perceived value (PV), which was 0.7444. Looking specifically at the assessment of the model through Dijkstra-Henseler's rho (ρ_A) shows that high composite reliability is available with values above 0.7 and below 0.9, which is the expected range for composite models [23].

By determining the average variance extracted (AVE), the results show each of the constructs with an indicator greater than 0.5, thus meeting the criterion established for this factor [24]. According to discriminant validity, IE has an AVE of 0.5261, PV is 0.5658, SL 0.6277, and IE obtained 0.5490. These indicators confirm that the model is reliable and the results are consistent (see Table 3).

Table 3
Discriminant validity results associated with the model.

Construct	IE	PV	SL	TE
IE	0.5261			
PV	0.1146	0.5658		
SL	0.0539	0.4424	0.6277	
TE	0.0584	0.1176	0.1017	0.5490
Squared correlations (AVE in the diagonal)				

Regarding the direct effects between the constructs of the model, the significance between variables was evaluated through p-values. Table 4 shows that the significance between the perceived quality of the intangible elements (IE) of the Hotel Sonesta Loja establishment and the perceived value (PV) is less than 0.01, which indicates that the relationship between these two constructs is significant at 99%. It is also true between perceived value (PV) and level of satisfaction (SL), as well as between tangible elements and perceived value. On the other hand, when analyzing the direct effect between the tangible elements (TE) and the level of satisfaction (SL) of the clients of the Hotel Sonesta Loja, the p-value was less than 0.05 (p-value=0.0236), which determines a significant linkage at 95%. Therefore, H1, H2, H3 and H4 are accepted.

Table 4
Inference of direct effects between each of the constructs of the resulting model

Effect	Original coefficient	Mean value	Standard error	Standard bootstrap results		
				t-value	p-value (2-sided)	p-value (1-sided)
IE -> PV	-0.2714	-0.2923	0.0672	-4.0390	0.0001	0.0000
PV -> SL	0.6298	0.6320	0.0584	10.7773	0.0000	0.0000
TE -> PV	-0.2773	-0.2803	0.0611	-4.5406	0.0000	0.0000
TE -> SL	-0.1030	-0.1076	0.0518	-1.9870	0.0472	0.0236

In general, the model developed for the Sonesta Loja Hotel is consistent and reliable. The tangible and intangible elements significantly impact the perceived value, which, in turn, on satisfaction.

4. Discussion and Conclusions

The system for measuring aspects associated with the quality of service provided by the Hotel Sonesta Loja has redundant approaches and lacks others that could provide better information. That agrees with [1], [2], who mentions the importance of having tools that allow determining the factors that customers consider when measuring service quality.

The significance values determined for the relationship between the different constructs allowed us to conclude that there is a very significant link between the perceived value and the level of satisfaction in the clients of Hotel Sonesta. That fact enables inferring that customers make an evaluation considering the relationship between the quality of the service received and the price [10], [1]. The fact that there is a very significant relationship between tangible elements and perceived value reinforced that derivation. Therefore, some relevant details for hotel guests are the room's cleanliness, the condition of the room furniture, and the bed arrangement.

Concerning the quality of intangible elements and perceived value, there is a very significant link between these constructs. Specifically, guests' waiting for time check-in or check-out, as well as the friendliness of the staff, are relevant to the customers' perception of the quality of the service-price relationship [6], [7]. The tangible elements of the hotel and their associated quality have a significant relationship with the level of customer satisfaction. In other words, guests consider the cleanliness and tidiness of the rooms to be decisive for their rest.

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The effect of the use of ICT on the Touristic Experience

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Abstract

The quick adoption of information and communication technologies (ICT) across the world, particularly in tourism, aiming to revolutionize the creation of the travel experience or improve it, happens without specifying the most appropriate ICT or its actual results. While visitors adopting personal ICTs in search of fluid, efficient and personalized trips, emerge; regardless of the tourist destination, empowering themselves with smart devices in pursuit of extraordinary experiences and value. The objective of this research was to comprehend the effect of the use of ICT by tourists on their travel experience. Mexican tourists traveling within the country for pleasure using smart devices with internet connection were evaluated. Data were obtained using snowball sampling on social media and analyzed with SEM to define the relationships and the factors that are affected and comprise the smart tourist experience. The results show that there is a preferential use of smartphones and tablets and search engines and maps rather than applications (apps). Also, a notable influence of ICT is experiencing something new and enjoying activities that the tourist wanted to do. The factors comprising the smart tourist experience are learning about oneself during the trip, making the trip more exciting and memorable, and feeling surprised.

Keywords

Use of ICT, Smart Tourist Experience, Emotion, Smart Tourism, Tourist Experience

1. Introduction

Internationally, billions of people have unprecedented access to mobile technologies [26]. This rapid and intense adoption of ICT in all fields of the human sphere has caused a fundamental change in how tourist experiences are created, exchanged, consumed and shared [6,8].

Although the concepts of smart tourism and smart destinations have been widely promoted, these concepts may be far from the reality of destinations and tourists [7]. ICT adoptions in destinations were aimed to achieve personalization, access to services, and the provision of information in real-time [1,6]; but the industry is still unaware of which are the most appropriate ICTs based on preference, functionality, intensity of use, satisfaction, or improvement of the experience [11] in addition to there being little questioning and analysis regarding whether these adoptions have improved the experience [8, 15, 19]. We note that the tourist in this context is considered only as a source of information.

1.1. The touristic experience

The experience is being studied by marketing scholars as experience of consumption using models such as the thought-attitude and emotion model of Holbrook and Hirschman of 1982, the cognitive-affective model of Engel et al. from 1978, the information processing model, the experiential model and various integrative models; but mostly on the theory of consumer culture and Service-Dominant Logic (SDL) [5]. Here, the experience is influenced by the consumer's goals, schemas, information processing, memory, participation, attitudes, affect, atmospheres, attributions, and choices. It has a

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holistic nature that involves the client cognitively, emotionally, and affectively, generating social and physical responses towards the organizations that provide products and services [5].

Regarding the touristic experience, authors such as Quinlan Cutler and Carmichael (2010) define it as a subjective, intangible, continuous and highly personal phenomenon. While Pine and Gilmore (1999) define it using four unique dimensions: education, escapism, aesthetics and entertainment, which are explained by Tan (2017), as follows: the experience of escapism relates to the fact that tourists are "immersed" in the environment, which results in the feeling of escaping from their daily lives, the entertainment experience occurs when tourists passively observe the activities that take place in a destination, the aesthetic experience is created when tourists passively enjoy and appreciate being in the destination environment, and the educational experience occurs when tourists increase their knowledge or skill [21].

Tourists are regarded as coproducers of the experiences [18, 21], experiences are complex ones that provoke memories and emotions related to places. Therefore, a place or a self is experienced in a place. The vacation experience is highly subjective, it is integrated by a search for authenticity, identity and self-realization, in addition to the search for a multifaceted leisure activity, which is significant for the individual. Experiences are made up of sensations, emotions and images, among other hedonic components, in addition to satisfaction. [17, 18]. In addition, Prebenson et al. (2014), consider that there are psychological benefits of the travel experience: relaxation, learning, socialization, and mastery (competence).

Note: personal experience is what is of interest in this research. The word experience is recently being used as a synonym for "touristic product".

1.2. Smart experience

According to Gretzel, Sigala, et al. (2015), the experience in the context of smart tourism is efficient and rich in meaning. In it tourists are active participants in the creation of it [8]. Here, the journey also happens in the virtual space [21], consumers have virtual experiences, which leads to the construction of an expanded self and the possibility of a plural identity during digital experiences [5], particularly with the use of smartphones, the experience has been further transformed and travellers are empowered by bringing together information, communication, entertainment, social networking, and mobility-related functionalities [28] in their search for experiences and extraordinary value [12].

Some authors mention that the use of smartphones encourages unplanned activities. They are seen as a portable platform to be in community, socialize and encourage or facilitate opportunities for interaction between tourists, which is recognized as a source of vacation experience satisfaction [24]. We could say the visitor could be creating his own tourist experience by generating for himself a tailor-made touristic product and by regulating his personal experience by using ICT.

On the other hand, the authors indicate that the study of the tourist has been neglected [15, 19], there is a lack of knowledge regarding the access and level of adoption of ICTs by the tourists and the existence of tourists [13], whether in regular or smart tourism contexts [29], and the behaviours previously described in the literature are taken for granted [19].

There is a lack of empirical support to demonstrate that tourists are "smart" meaning they want to have a super connected experience or are able of [7], whether they are at smart or regular destinations. The absence of studies that show that the smart tourism allows the tourist to have better experiences is also recognized [8]. Considering these conditions, the research question to be addressed is: What is the effect of the use of ICT by the visitor in the travel experience?

2. Methodology

We used Structural Equation Modelling (SEM) to determine if there is a relationship between the independent variable Use of ICT and the dependent variable Experience. Because the experience variable is a latent variable, this conducted to the factors affected that could compose the smart experience.

2.1. Scope and limitations

The ICT Use variable includes the use of smart devices connected to the Internet, including cell phones, tablets, laptops, smartwatches, and desktop computers during their trip, both the use of software (search engines, maps, videos, social networks, travel apps, etc.) and hardware (type of smart devices), the kind of Internet connection, the level of use and the utility that the devices had in activities related to the trip. In this sense, no in-depth study was carried out on applications for mobile devices, nor the use of search engines and internet pages.

Tourist experience as a synonym for the touristic product [12], is not addressed in this study. Personal experience is studied, and it includes an emotional component.

2.2. Analysis units

The study focuses on Mexican men and women over 18 years old and up to 70 years old, who reside in the country, with higher than secondary education (undergraduate and postgraduate), and who have visited a destination within Mexico for pleasure in the last six months and have used electronic devices with an Internet connection (smart devices) during this trip.

2.3. Sample

Snowballing sampling was used for the data collection, which was done online, following [14, 3, 9], recommendations for the sample size and increase the representativeness and validity of the study. We calculated a universe of about 19,080,758 people. Given the recommendations of [3, 23], and considering the availability of the researcher resources, a simple random probabilistic sample was calculated, using a confidence level of 90%, with a margin of 0.055 error, following statistical sampling conventions, using the formula for finite population. The number of resulting questionnaires was 224.

$$n = \frac{Z^2 * N * p * q}{e^2 * (N - 1) + Z^2 * p * q}$$

2.4. General research design

The general design of the research allows evaluation of the effect of the Use of ICT in the Experience (which is a latent variable), this is shown in figure 1.

H1: the use of ICT has a positive relationship and an incremental effect on the Touristic Experience.

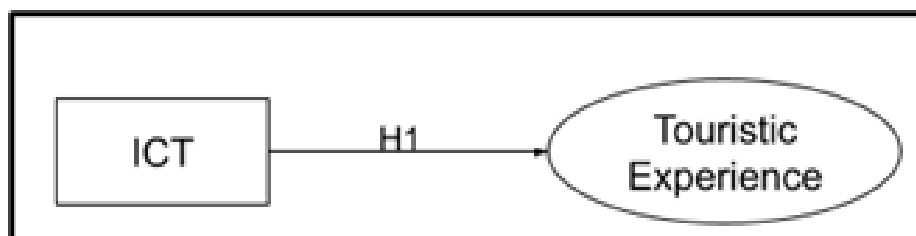


Figure 1: General research design Source: prepared by the author

2.5. Instruments

An online questionnaire was created using Google Forms from the Google Suite, with 47 reagents, which allow profiling the interviewee, allowing to know the generalities of the trip, the Use of ICT, and

the Tourist Experience. The questionnaire was tested and adjusted through two pilot tests. The results were emptied in SPSS and examined using Cronbach's alpha to check reliability and factor analysis to confirm the validity of the instrument.

The reagents used for the evaluation of the level of Use of ICT were based on the proposal of [22], and modified from the researches of [24, 25, 29] and [29, 10]. The reagents to measure the Touristic Experience were taken from those of Rivera Lozano (2018) and modified based on the items used in the studies by [16, 2]. The experience construct encompasses factors such as feeling excited, free, close to the local, feeling surprised, feeling confident, getting out of the routine, experiencing something new, different or unique, experimenting, developing personal identity, learning something, generating new skills, having meaningful experiences, having different emotions, memorable experiences, participating in activities, feeling revitalized or refreshed, and enjoying.

2.6. Process

To obtain the data, social networks and chats were used as a means of distribution of the questionnaire based on the recommendations given by the Electronic Marketing Manual for Tourist Destinations [27], as well as by authors such as [22].

The questionnaire had to be filled out on one occasion. The information was collected from November 2019 to January 2020. Social network users were considered more likely to have used mobile devices with an Internet connection during vacations, so it was considered that what [14], call "likelihood with the real population". The people were contacted personally, using social networks such as Facebook, as well as Facebook and WhatsApp chats, through which they were asked to participate and to invite more people who met the profile to answer the questionnaire online, the link to the questionnaire was provided by these means too.

We obtained 227 questionnaires, of which 224 were valid. The data was loaded to Microsoft Excel from Microsoft Office 2011, to be coded and normalized, necessary to perform a principal component analysis (PCA) (Fearn, 2011), or factorial analysis. This standardizing technique does not lose any generality and allows to achieve zero mean and unit variance (Acock, 2013; Joliffe & Morgan, 1992) and retains a greater proportion of the original variation by using derived variables instead of a simple subset of variables (Joliffe & Morgan, 1992). Subsequently, an exploratory and confirmatory factorial analysis was performed using the Stata13 program. Then, for Use of ICT, an index was created using PCA. Subsequently, we modelled through SEM with Maximum Likelihood using the SEM builder of the Stata 13 program, following the suggestions given by [23]. The model was evaluated and respecified using the modification indices to explain more variance in the model.

3. Results

The sample is made up of 224 people, of which 132 are women (59%) and 92 are men (41%). 30% of the sample studied at least up to basic education level (high school), 45.8% to a higher level, and 24.2% to a postgraduate level. 99.6% indicated that they used their smartphone during their trip, 85% indicated that they always use their smart devices during vacations and 10.7% that they do so almost always; 64.4% declared that they always plan their trips and 26.7% that they almost always did too, while 64% assign a budget to their vacations and 23.6% almost always assign a budget to them. Only 12% hire accommodation services, food and beverages, recreation, etc., once in the destination.

The most used hardware with WiFi and internet data is the smartphone at 76.33%, while only with WiFi it was the smart tablet at 21.87%. The most used device was the smartphone with 91.96% and the most useful with 94.19%, followed by the tablet with 16.07% being the second most useful with 20.53%. The phone is the most used for all online activity, especially for searching travel information in the tourist destination, communicating with friends and family, and sharing their experience with family and friends (with up to 78.12%). The second most used device was the laptop, for information search and facts confirmation (with a maximum percentage of 10.71% in each activity).

Regarding the use of software or applications, the most used were search engines, followed by maps and social networks. The number of applications used according to the type of destination is higher in colonial destinations, followed by urban ones. The constant use of map and GPS software stands out.

The descriptive statistics about the influence of ICT on the experience is shown on table 1. Regarding emotions, one of the components of the experience, 78.3% indicated that the trip was surprising due to the use of smart devices with an internet connection, in the same way, 77.46% felt excited about their trip, 84.9 % felt safer by using such devices, while 85.3% felt that the destination was safe for the same reason.

The results of the modelling show that not all the factors are affected in a significant way. Factors whose significance is 0.000 were retained in the model. The Use of ICT affects more the learning about oneself during the trip, making the trip more exciting, memorable, and feeling surprised. The significance of the effects of ICT use on the travel experience is 0.001, and its effect is positive since, for each point of technology, the experience will increase by .086 (see figure 2). The goodness of fit shows that at least 93.4% of the covariance in the data can be reproduced by the proposed model (see Figure 3).

Table 1

Experience affected by the Use of ICT. Source: prepared by the author

Percentage	Changes in Experience due to the use of ICT
73.21%	Indicated that she/he experienced something new
58.03%	She/he participated in different activities during the trip
66.51%	Enjoyed activities that really wanted to do
54.91%	She/he had an experience different from previous ones
46.87%	She/he considered that she/he enjoyed his trip at every moment
50.44%	She/he was excited to have new experiences
36.16%	The travel experience made her/him feel revitalized
37.05%	She/he learned something about himself on the journey
44.19%	She/he experienced things that surprised him/her
40.17%	She/he felt that she/he did something significant on the trip
39.73%	The trip helped him/her acquire new skills
47.76%	She/he felt freer during the trip
50%	She/he experienced the local culture more closely
44.19%	She/he considered his trip to be a memorable experience
39.28%	She/he felt that the trip helped him improve his confidence

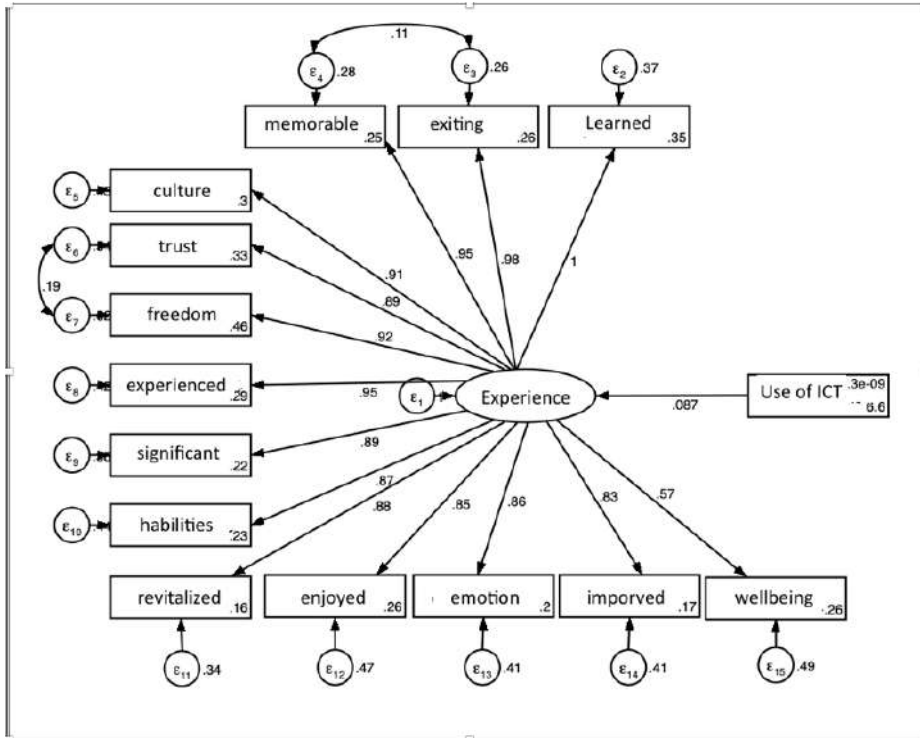


Figure 2: SEM Use of ICT effect on touristic experience. Source: prepared by the author

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms (88)	258.698	model vs. saturated
p > chi2	0.000	
chi2_bs (105)	3083.786	baseline vs. saturated
p > chi2	0.000	
Population error		
RMSEA	0.093	Root mean squared error of approximation
90% CI, lower bound	0.080	
upper bound	0.106	
pclose	0.000	Probability RMSEA <= 0.05
Information criteria		
AIC	7903.653	Akaike's information criterion
BIC	8057.177	Bayesian information criterion
Baseline comparison		
CFI	0.943	Comparative fit index
TLI	0.932	Tucker-Lewis index
Size of residuals		
SRMR	0.034	Standardized root mean squared residual
CD	0.047	Coefficient of determination

Figure 3: Modelling goodness-of-fit results

4. Results

The results show a tourist who is similar to the one found by [10]. They prefer the smartphone at all times, and if WiFi is available, tablets are preferred. They search for information and help themselves with the logistics of the trip through online maps. They use the web similarly to what [24, 7] reported. In our sample, more than 60% report having carried out activities that allowed them to personalize their trips and about 80%, searched for experiences and activities, structured and modified their trip looking

for better prices, for which it is considered that the use of ICT allows travellers greater efficiency in the planning and execution of the trip.

Unlike what was reported by [7], our tourists frequently used ICTs to communicate with friends and family and share their experiences with them, similar to what was reported by [10].

Regarding the Travel Experience, the empirical data shows that the use of ICT was considered as responsible for experiencing new things and different activities or activities that they wanted to do and having a happy trip, in addition to feeling that the destination was safe. This may be because the ICT allows them to discover the destinations to navigate them by themselves and adjust the trip to achieve their objectives. This result is similar to the contribution of [24].

This is one of the most interesting results since it tells us about the behaviour and how a smart tourist, present in regular destinations, could be defined, also showing a visitor who actively participates and is not only a provider of information for the tourism industry.

Regarding the SEM modelling, for the hypothesis the goodness of fit statistics are as follows: the CFI was 0.943 indicating that at least 94.3% of the covariance in the data can be reproduced by the model, the TLI index of 0.932. The RMSEA of 0.093 and the SRMR of 0.034. Based on the goodness-of-fit statistics, hypothesis 1 is verified: the use of technology has a positive relationship and an incremental effect on the experience. With the previously described, the objective of evaluating the effect on the Experience during pleasure trips from the use of smart devices with an internet connection by the tourist is considered fulfilled.

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Smart tourism: Mobile application with augmented reality to promote the use of virtual tourism for the archaeological zone of Caral, Peru

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Abstract

Due to COVID-19, the tourism sector had a loss of visitor revenue of 56%. For tourism in Caral, Peru for 2020 there was a 95% reduction in the annual number of visitors expected. Therefore, the research aims to develop a mobile application for Android with augmented reality to show 3D models and audiovisual content that allows to promote the use of virtual tourism for the archaeological zone of Caral, Peru. To this end, an applied research is developed with a quantitative approach following an experimental methodological design through the pre-experimental method for which a sample of 50 users was taken. To measure this experiment was based on the use of indicators of time of use of the application and the use of augmented reality in the application. The results obtained an average time of use of the application of 0:08:25 minutes while the average time of use of augmented reality in the application was 0:03:36 minutes. Likewise, the results show a great interest on the part of users towards the implementation of augmented reality in an application focused on tourism.

Keywords

Augmented reality, smart tourism, virtual tourism, mobile app

1. Introduction

Tourism worldwide in countries means a large percentage of GDP, reaching up to more than 20% in some of these. However, during the first period of COVID-19, the entry of tourists worldwide decreased by 56% and there were losses of 320 million dollars [1]. For example, tourism in Peru has been one of the most important economic activities, reaching 3.9% of GDP in 2019 with revenues of 4,784 million dollars [2]. However, with the appearance of the COVID-19 pandemic the country was affected, harming all economic sectors, thus causing a 75% drop at the financial level [3]. In this way it happened in the archaeological city of Caral during 2020, which had a reduction of 95% of the annual number of visitors expected which led to a loss in their income of that percentage [4]. This led the tourism sector to think about a restructuring necessary for the reopening and sustainability of the business. This restructuring focused on allowing the business to be sustainable and to be able to achieve digitalization with the use of information technologies. From this search by tourism businesses, the concept of smart tourist destinations is known. This would seek to have a cutting-edge technological infrastructure included in its processes and services, allowing to ensure that its development is sustainable [5]. In this way we have the concept of smart tourism, which can prepare a recovery of the business together with the most innovative information technologies [6]. One of the technologies that have been integrated to display information is augmented reality. Which has proven to be an innovative opportunity that focuses on user interaction [7]. Therefore, augmented reality has been part of the technologies proposed to implement smart tourism [8]. Also, part of this solution is virtual tourism, which allows greater access to tourism and technology remotely [9]. This led to the development of smart tourism in Europe and Asia. Which, in 2021, Peru reached an agreement with Spain, considered a pioneer country of smart tourism, to develop the concept of Smart Tourism in the country [10], [11]. In recent research it has been proposed to integrate augmented reality through mobile applications to display information interactively

[12], [13]. As well, develop virtual tourism as an alternative for a new experience and interest for tourists [14]. Therefore, one of the objectives of the research is focused on analyzing the current context of tourism in Caral as well as identifying the necessary requirements to develop virtual tourism through a mobile application with augmented reality. With this, it is proposed to develop a mobile application with augmented reality with the purpose of promoting the use of virtual tourism for the archaeological site of Caral. Therefore, we ask ourselves the following question: How does the development of a mobile application with augmented reality promote the use of virtual tourism for the archaeological zone of Caral, Peru?

2. State of the Art

2.1. Smart Tourism

Tourism has been experiencing continuous growth over the years due to new technologies and methods to provide services [15]. This is how the concept of smart tourism appears, which has been taking on greater relevance due to the need for new opportunities to innovate in the tourism service. With this in mind, we observe that the use of smart devices in everyday life is much more common, which makes it possible to explore ideas such as the design of smart cities or smart tourist destinations [16]. In this way, smart tourist destinations are designed to have a total approach to the business, thus allowing it to be sustainable in the long term to achieve observing the results [17]. For this, it is necessary to understand the elements that surround the concept of a smart tourist destination and that allow the project to be integrated in all its aspects [10].

2.2. Turismo Virtual

Due to the negative impact that COVID-19 had on the tourism sector, an idea was developed that allows the tourism sector to be maintained through virtual technologies [18]. Through technologies that allow a virtual immersion of the user, virtual tourism is developed that will allow tourists to be part of an experience different from that obtained in traditional tourism creating interest in it. According to studies, they have obtained positive sensations from tourists for the use of virtual tourism as a response to a crisis situation or difficulty in accessing traditional tourism. Likewise, a design of a smart tourism has been sought by applying a virtual tourism in order to obtain an immersive experience for tourists [21]. Thus, with this concept, different ideas have been developed in order to respond to a crisis that prevents them from continuing to carry out their traditional activities and moving to a virtual medium. The tourism sector had not foreseen before an option other than traditional tourism until the pandemic that led to virtual tours to maintain the tourism sector as a sustainable business [22]. However, it is necessary to emphasize that virtual tourism will not replace traditional tourism, but will complement the tourist experience for the services provided by tourism [23].

2.3. Caral Tourism

Tourism in Caral has a great variety of ceramics and instruments that they used for their religious and musical ceremonies as well as their pyramidal buildings built with quincha [24]. Caral has had a constant growth over the years. The annual visits that the archaeological zone received were in continuous growth. According to the analysis of the archaeological site of Caral, there has been a significant decrease due to the COVID-19 pandemic [25]. Thus, having an economic loss compared to the years 2019 and 2020 of 87% [26].

2.4. Realidad Aumentada en Aplicaciones Móviles

At present, studies related to augmented reality have seen a growth of great potential to be implemented in mobile applications. One of the studies reviewed by Spallone & Palma [13] contemplates a solution through digital innovation, which collects information for visits to the archaeological sites of Rome. This research focuses on the use of the mobile application to recognize monuments and display information about them through 3D modeling of each of them. A similar look is given with the research of Hincapié et al. [27], which sought an innovative solution that works on the experiences of tourists and its value as a tourist site of Plaza Cisneros. The use of augmented reality in the mobile application was based on showing through a map a marked guide of historical places, which attracts the curiosity of tourists.

3. Research Methodology

The methodological design of the research will follow an experimental design in order to apply measuring instruments to obtain the results. Likewise, it will be developed with the pre-experimental type because it will work with a reduced sample.

With this, to measure the use of virtual tourism, we worked with the time indicators of the use of the application with all the functionalities and the time of use of the augmented reality functionality. To obtain the results, an observation guide was developed in which the variable of the impulse of smart tourism was validated. For the first indicator, we looked for groups of users to whom to pre-send the proposal to be part of the experiment. For the selection of the sample, it was taken into consideration that they are users among children, young people or adults of any sex who have made a visit to a tourist site. A group of 65 people were told to be part of the experiment using the mobile app. Of the total number of people, 50 users agreed to be part of the experiment. To do this, the Android Package Kit (APK) developed for research was delivered. Each of these users had a mobile device with Android operating system through which they would access the application.

For the mobile app, it started with the creation of the mobile app architecture. The software in use for the construction of the application was considered as well as the permissions that would be required for its use. (See Fig. 1).

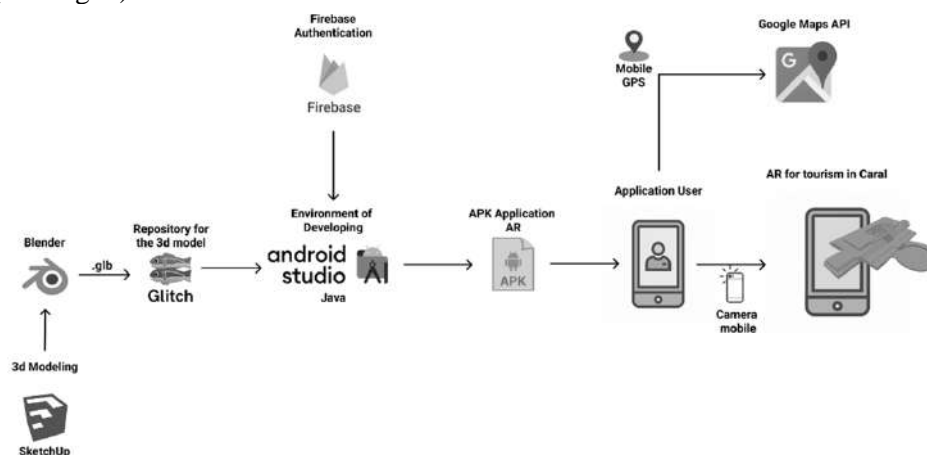


Figure. 1 Mobile App Architecture

The mobile application will consist of 10 screens developed in Android Studio with the Java programming language. These screens will be the welcome screen, login screen, user registration screen, main menu screen, Caral history screen, history augmented reality screen, Caral pyramids screen, pyramid description screen, Caral Map screen, the augmented reality screen of the pyramids of Caral (See Fig. 2).

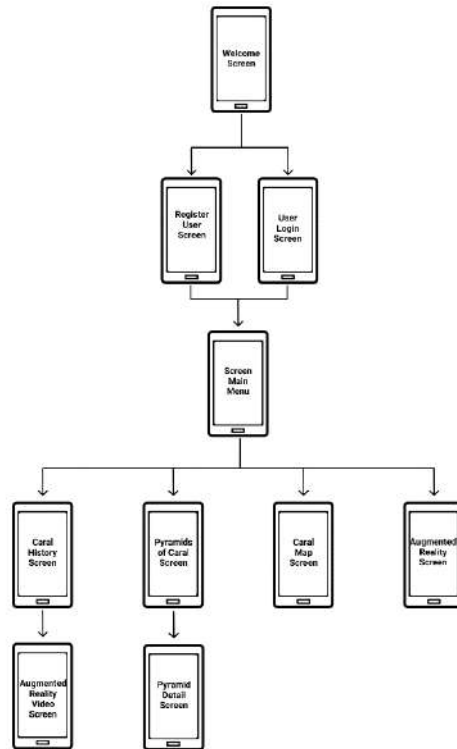


Figure. 2 Mobile app screens

For the functionality of the augmented reality screen, we work with the type of augmented reality without markers, so it is necessary to detect a flat surface with the camera of the mobile to show the 3D object and the information video. For the application we work with a 3D model of the major pyramid of Caral because it is one of the most attractive points of Caral (See Fig. 3).



Figure. 3 Augmented reality of the Great pyramid of Caral in the mobile application with a reference image and the 3D model used.

The following augmented reality functionality will show a video about the socio-environmental system model of Caral's culture. Through the sensors of the camera, as in the previous implementation, a flat surface will be detected on which to load the audiovisual content (See Fig. 4).

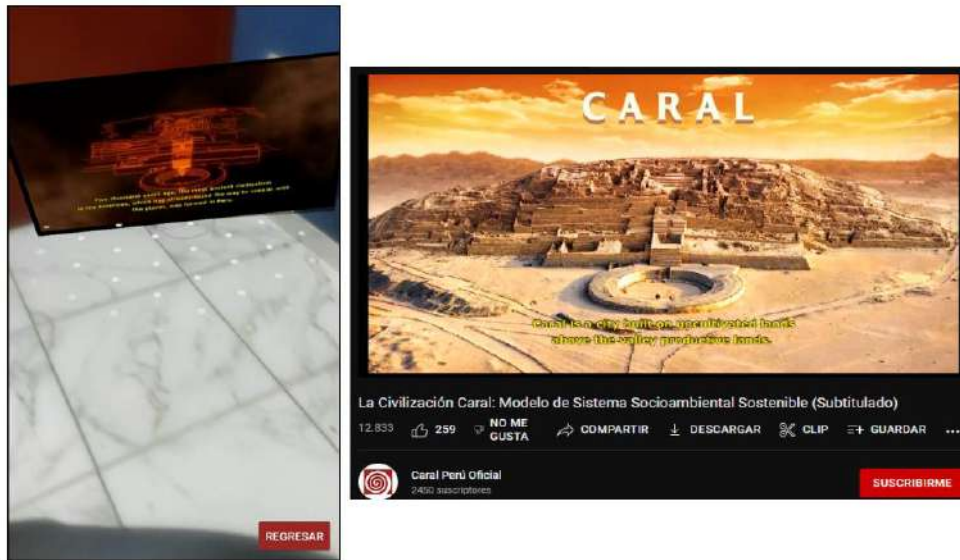


Figure. 4 Augmented reality making use of audiovisual content from Caral's socio-environmental system model.

Finally, based on the research of this new application with augmented reality to be implemented in Caral would taken 4 months. This time will focus on the 3D modeling of the 6 main pyramids of Caral and the development of the application. For the costs of the application, a minimum budget of \$500 is foreseen be-tween the resources, the modelling process and the development process.

4. Results and Discussion

For the results related to the participants of the experiment, 50 users interested in carrying out the experiment were obtained, achieving a total of 1 81% interest in this new mobile application (See table 1).

Table 1

Observation guide for the percentage of users who make use of the mobile application

A=Total number of users using the group application	B= Total number of users in a group	=A/B
50	65	81%

As a next point we have the results of the indicators of the time of use of the mo-bile application and augmented reality. For the result of the first indicator, an average time of use of the application of 8:25 minutes was obtained from a total of 50 users (See table 2). The evaluation was carried out with the Student T test for a sample with a test value of 0 since there is no previous record of the use of a mobile application with augmented reality in Caral. A longer time of use of the mobile application is reported (M=0:08:25, DE=0:02:08) than the normative sample with the characteristics (t (49) = 27.782, p<.001) (See table 3).

Table 2

Statistics for a sample of the indicator time of use of the mobile application

	N	Average	Deviation typ.	Error Typ. Of the average
TiempoUsoAplicación	50	0:08:25	0:02:08	0:00:18

Table 3

Student's T-test for a sample of the mobile app usage time indicator

TiempoUso Aplicación	Valor de prueba=0					
	t	gl	Sig. (bilat- eral)	Average dif- ference	95% confidence in- terval for difference	
					Inferior	Superior
	27,782	49	,000	0:08:25	0:07:49	0:09:02

For the following indicator of the time of use of augmented reality, an average time of 3:36 minutes was had (See table 4). Student's T-test, as with the first indi-cator, reported a longer time of use of augmented reality functionality (M=0:03:36, DE=0:01:32) than the normative sample (t (49) =16,510, p<,001) (See Table 5).

Table 4

Statistics for a sample of the indicator time of use of augmented reality

	N	Average	Deviation typ.	Error Typ. Of the average
TiempoUsoAplicación	50	0:03:36	0:01:32	0:00:13

Table 5

Student's T-test for a sample of the augmented reality usage time indicator

TiempoUsoAplica- ción	Valor de prueba=0					
	t	gl	Sig. (bilat- eral)	Average dif- ference	95% confidence in- terval for difference	
					Inferior	Superior
	16,510	49	,000	0:03:36	0:03:10	0:04:02

As a starting point, we have the beginning of a smart tourism through the mobile application with augmented reality. As Mohanty points out [6], the augmented reality IT tool is innovative and provides a new experience for the tourist as observed in research through the times of augmented reality use. As Neiva mentioned [10], for the concept of smart tourism to be fully applied it is necessary to continue developing the other components such as IT governance, human capital, sustainability and economic capital. We can reaffirm with research that applying a virtual tourism will be a complement service to traditional tourism as mentioned by Talafubieke [23].

Para For users who made use of the mobile application, they found this new way of making their visit to Caral interesting. They consider that it gives them a greater approach to history and that they can complement what they have learned. On the other hand, some users reflected in their observations ideas to complement the application when displaying the information or improving the functionality.

5. Conclusions

Finally, through research it has been possible to meet the main objective through the experiment executed. First, it has been possible to know what has been happening in Caral and how it is possible to promote the use of virtual tourism through the concept of smart tourism. It has been possible to take the first step through the implementation of a mobile application with augmented reality so that the tourist can experience a new way of accessing the information of the site he visits or is interested in knowing. In addition, the development of the application is fulfilled based on requirements of previous studies that had the implementation of augmented reality for different market sectors. Through the results, it was possible to obtain a high degree of interest from users to make use of a mobile application with augmented reality. For the use of the application there was an average time of 0:08:25 minutes. While for the use of augmented reality there was an average time of 0:03:26 minutes. It was able to

identify that there is an opportunity with augmented reality technology to provide a virtual tourism service and also implement it in the tours of Caral, since it is a new experience for tourists.

Based on the observations obtained from the research, the project can continue in a future development in order to realize a long-term implementation in collaboration of the archaeological site of Caral.

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Media production to promote a tourism product related to wildlife watching. Case: Digital series Voices of the Forest, San Martin, Peru

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Abstract

Managers of tourist destinations and products worldwide are in a constant search for innovation, improving their design processes, tourist service and promotion, with the intention of increasing the interest of travelers and improving the experience of their visit. In this context, new communication formats are emerging, highlighting audiovisual production in different formats, such as audiovisual series, as an effective and innovative format.

This article will analyze the production of audiovisual series related to wildlife observation and in particular, the case of the audiovisual series Voices of the forest, which is a digital series related to wildlife observation and whose objectives are to contribute to generate interest in traveling to Alto Mayo, in San Martin, Peru, and motivate the audience to carry out wildlife observation activities.

Keywords

Video induced tourism, Wildlife based tourism, Digital series

1. Introduction

1.1. Video-induced tourism

According to Araujo and Fraiz (2012) both the audiovisual sector and the travel sector offer leisure alternatives to people and are independently in the economy of experiences, but also the audiovisual sector can be linked to the activity of traveling, since audiovisual productions can provide the possibility of living and moving to places that in the future they may want to know or visit.

For example, a research study verified that the number of tourists increased 50% during the 5 years following the filming of 10 movies in different destinations. Likewise, this phenomenon gave rise to the name Set-jetter, which comes from set, stage, and jet, to fly, and refers to the traveler who has a travel motivation related to the destination seen in a movie.

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Based on this concept, there is great interest in transferring the benefits of cinema to a larger field, the audiovisual series, which, just as cinema, which proved to be very effective compared to the traditional promotion of tourist destinations within many cases, and can transfer certain parameters to the development of series or other audiovisual products, being a new opportunity as a tourism promotion tool [1].

According to, Araujo and Fraiz, some of the most important parameters are: (1) High involvement of the viewer with the narrative story, characters, and events of the series, (2) disbelief is suspended, fiction becomes reality, through the understanding of the story and images of the series and (3) The consumption of experiences through the feature film or series induces a desire to recognize the images and story of the series [1].

It is important to emphasize that the audiovisual media has an important influence on tourism destination image perception [2], and this is because visuals are currently more important than written material [2].

In that sense, tourist destinations or attractions that appear in films and series can generate greater recognition and admiration from viewers compared to a regular advertisement. These audiovisual media can produce empathy in consumers, that is, the audience gains shared affection, putting themselves in the place of the protagonist of the story and in many cases wish to live a similar story [2].

1.2. Tourism based on wildlife observation

As part of nature-based tourism, wildlife watching is a very popular activity [3] that is related to the scientific study of nature [4]. In addition, it contributes directly to support nature conservation by increasing environmental awareness and education among visitors and local populations [5], as well as generating funds for activities that conservation requires.

The UNWTO indicates that wildlife watching tourism is associated with an animal species or a group of species, highlighting worldwide buffaloes, elephants, leopards, lions, rhinos, gorillas, lemurs, birds, whales, and dolphins [6].

Until before the pandemic by COVID-19 it was identified that more than 8 billion people approximately visit protected terrestrial areas worldwide each year, generating approximately \$600 billion per year in direct expenditures and \$250 billion per year in consumer surplus [7]. Likewise, within the benefits of visiting protected areas, it has been identified that interaction with nature generates physiological, physical, and social well-being [8, 9]. Due to the pandemic, these benefits have been placed higher levels of importance [10] and protected areas such as other natural spaces have become of greater interest.

About birdwatching, it is the practice of observing and identifying birds in their natural habitats by sight and sound [11], it is an activity related to nature-based tourism, which shows a worldwide expansion [12].

For example, according to U.S. Fish and Wildlife Service, birdwatching is the leading wildlife watching activity in the United States with approximately 45 million enthusiasts [13] and is one of the most popular outdoor recreational activities in Western countries [14]. Also, it has started to become more popular in other latitudes, especially in remote areas where more rare bird species can be found [12].

2. Background on video-induced tourism related to wildlife

The productions related to tourism and wildlife watching are mainly associated with nature documentaries. There are many cases such as Our Planet, The Earth, Earth, A Life on our Planet, among others. Although these are very advanced audiovisual projects with high quality pre-production, image, production, and post-production, with large production companies and millionaire investments, their link with a particular destination or tourist product could be quite limited.

However, based on the concept of film-induced tourism, the appearance of natural spaces in these documentaries generates travel interest in terms of the ecosystems, landscapes and species shown, which are usually varied and refer to many places on the planet.

In addition, in recent years, documentaries related to more specific themes and territorial spaces have been shown on the main streaming platforms, which are linked to tourist destinations and/or attractions, as detailed below:

Table 1
Wildlife documentaries or audiovisual series identified

Streaming platform	Documentaries or audiovisual series
Netflix	<ul style="list-style-type: none"> ● Dancing with the Birds ● Pacificum ● Birders
Amazon prime	<ul style="list-style-type: none"> ● Galapagos ● Iceland ● Spirits of the Congo
YouTube	<ul style="list-style-type: none"> ● The Birders

Although most of the documentaries mentioned in the preceding table are not major film productions, and are mainly developed by independent production companies, in some cases with government funding in each country, they still have a considerable investment and broad expertise in the audiovisual field, mostly executed with an interest particularly related to the conservation of species and ecosystems and/or for environmental education purposes. It should be noted that these documentaries have been emerging recently, but before the pandemic.

An interesting case is *The Birders*, which stands out as an exceptional case for clearly considering an additional objective to those indicated before, to influence the interest of the birdwatchers' market to visit Colombia, with the intention of carrying out birdwatching and other nature-based activities. This audiovisual project was co-financed by government agencies in charge of promoting tourism in that country.

In addition to the above, in recent years and as a result of the pandemic, smaller budget audiovisual projects have emerged, in many cases worked by the tour operators themselves, and in the best of cases in alliance with audiovisual professionals, with the intention of showing permanence in the tourist activity based on wildlife watching and to generate future travel intentions of people interested in this activity.

Also, at the annual conference of the World Bank's Global Wildlife Program, in late 2020, noted the need to use digital media to advertise tourism while travel restrictions continue or the tourism sector recovers fully, with a considerable growth in virtual tourism.

Wild Earth, for example, increased the number of viewers of its virtual safaris by up to five times at the onset of the pandemic and travel restrictions; virtual tours mostly free to users, although others have been conducted for a fee, helping to offset lost revenue from tourist visitation. Finally, one of the most important findings was that virtual tours provide a way for people to experience natural attractions from their homes, while inspiring future travel plans once restrictions are lifted [15].

According to the European Commission and Directorate-General for International Partnerships, virtual tours created by protected areas and nature-based operators have received considerable traction and interest worldwide [15].

Among the main projects are audiovisual series, streaming programs, and virtual tours, some of which are identified below:

Table 2**Identified wildlife audiovisual series and wildlife virtual tours**

Audiovisual series
<ul style="list-style-type: none">● Airpan, offers various 360° videos and photos of natural and cultural destinations around the world (European Commission and Directorate-General for International Partnerships, 2022).● WildEarth is a subscription service for accessing wildlife virtual tours.● Birds of Colombia - Virtual Tour, carried out by Manakin Nature Tours.● Tropical birding virtual bird tours, carried out by Tropical Birding.● Hummingbird Spot, is a channel that also develops different audiovisual material as a series with particular attention to hummingbirds.● Birds of San Martin Virtual Tour was an event organized by the National Chamber of Tourism, the Natural Protected Areas Service, and the ecotourism company Ikam Expeditions.

As can be seen in the preceding table, the audiovisual projects show very particular characteristics, mostly associated with a particular activity and/or destinations; in some cases we see some exceptions, where the business model is videos, such as Airpan and therefore offers a variety of videos of different destinations and activities; also highlights the case of WildEarth where the business model is the subscription of interested parties to participate in virtual tours and at the same time they are customers for future expeditions in person.

The peculiarity of the rest of the cases is that they are ecotourism operators, or related entities specialized in wildlife watching tourism that developed these projects and hope to increase their income by attracting more tourists or other related income.

3. Case presentation: Digital series Voices of the Forest, San Martin, Peru

Voices of the Forest is an audiovisual series that promotes wildlife observation and the stories of those who strive to conserve it, the series shows incredible expeditions in search of unique wildlife species in northern Peru and this season the Alto Mayo Valley was chosen to be the tourist destination.

Based on the concept of video-induced tourism and wildlife observation, and the analysis of the background presented, especially the realization of digital series and virtual tours developed by tourism companies, the ecotourism company Ikam Expeditions, in partnership with the production company Videa, Cinefotorental, Conservation International Peru and the Chief of the Alto Mayo Protection Forest, with funding from the Tourism Emprende program of the Ministry of Foreign Trade and Tourism, a program that finances innovative tourism projects, produced the digital series Voices of the Forest following the methodology presented below.

3.1. Methodology

Project Location: The project was developed in northern Peru in the departments of Amazonas and mainly in Alto Mayo, department of San Martin. Alto Mayo is located north of San Martin, in the provinces of Rioja and Moyobamba.

Duration: The project had a duration of 7 months, from December 2020 to June 2021. Note that supporting videos of species were recorded from 2018.

Materials and methods: For the audiovisual realization, the stages of pre-production, production and post-production were considered [16].

3.1.1. Pre-production

This is the planning stage, where the creative part of the series was defined, such as the concept, the chapters, and the main story to be developed for each chapter, the characters, the relevant wildlife species chosen for each episode, and the main locations, among others.

With the objective of promoting wildlife observation and the stories of those who work hard to conserve it, Voices of the Forest series proposed the development of short videos (between 5 to 8 minutes) referring to expeditions related to the search for wildlife species in the most important natural spaces of Alto Mayo, in the department of San Martín and surrounding areas of the department of Amazonas, Peru. Five chapters were planned: Hummingbird Route, Representative Birds of Alto Mayo, Nocturnal Fauna in Tingana, Wildlife in Tingana and Birding in Moyobamba.

Julio César Tello Alvarado, General Manager of Ikam Expeditions and an expert in wildlife research and monitoring, was selected as the main actor. Although he had no experience in audiovisual projects as a presenter, which required an induction and training in front of cameras.

Another interesting point to highlight is that the sites or locations selected were mainly unconventional natural tourist attractions, whose main characteristics are: (1) sites that are managed for their conservation, (2) high presence of wildlife species and biodiversity, and (3) there are companies or people in charge of providing services and facilitating wildlife observation.

The main locations in Alto Mayo, department of San Martín were: Arena Blanca Reserve, Parador Llantería, Fundo Alto Nieva and Sendero Royal (all in the zone of influence of the Alto Mayo Protected Forest), Tingana Concession, ZoCRE Morro de Calzada and Tahuishco viewpoint and port. In the department of Amazonas: Abra Patricia Private Conservation Area and Huembo Conservation Reserve.

For the creation of the scripts, research was carried out, mainly concerning wildlife species and natural characteristics of the ecosystems, as well as the itinerary proposed by the tour operator's team and shared with Videá's team.

Finally, in this part, the available budget was analyzed and based on what had already been planned, a recording plan was established. It should be noted that the chapters proposed shared locations, so the scheduling of field trips and recordings had to be very specific to avoid errors and generate additional expenses.

3.1.2. Production

It had two stages, the first was filmed in the city of Moyobamba for chapter 5: Birdwatching in Moyobamba. Initially, the main reason for this first shooting was to test the scripts, train the main actor, Julio C. Tello Alvarado, and analyze the first sample videos. It is important to point out that this chapter, carried out in the city of Moyobamba, did not require considerable logistical costs and only a local audiovisual producer was hired.

The second stage was more complex and included going out to wildlife observation sites. Videá's production team came from the cities of Lima and Chiclayo and was formed by three members who played the role of producer, cameraman and editor. From Ikam Expeditions, the team included two members, the main actor, and the person in charge of travel logistics and local coordination. The entire shoot took 23 days.

3.1.3. Post-production

It included two stages:

The first stage was related to the editing of the videos, the music and the colors of the images. Several prototypes were made, which required a lot of attention, especially those related to the sounds and the selection of images of the species; sometimes, because of the music, natural sounds were missed, or the selected images were not very attractive, so that were changed.

The second stage was related to the launching of the series, which involved coordination with other local organizations linked to tourism development and conservation. There was coordination with Conservation International Peru and the Alto Mayo Protected Forest, which belongs to the National Service of Natural Areas Protected by the State - SERNANP.

The launch was made through Facebook, on the accounts of the three organizations mentioned in the preceding paragraph. In the case of Ikam Expeditions, it was also presented on Instagram and later with English subtitles on YouTube.

For the main launch event of the series, which included an official presentation and the broadcast of the first episode, a small publicity campaign was carried out through social networks, which included making diagrammed material, publishing it on social media and paying for advertising.

Finally, it is important to point out that the screening of each chapter consisted of a reel that lasted less than a minute and appeared 2 days before the release of each chapter, the principal chapter video that was 4 to 7 minutes long and the publication of an article in the blog two days after each chapter was released.

3.2. Results

The chapters of the "Voices of the Forest" series are posted on Facebook, Instagram, and YouTube platforms (subtitled in English). In addition, articles referring to each chapter of the series have been published on the Ikam Expeditions website (<https://ikamexpeditions.com/es/bloges/>).

Table 3

Voices of the Forest series related output

Outputs					
•	Digital	series	on	YouTube	available on:
	https://www.youtube.com/playlist?list=PLhyNd6eGAdY4Jh2G2tybnViGQP04g7yNY				
•	Digital	series	on	Facebook	available on:
	https://www.facebook.com/watch/100063902924173/403226434556699				
•	Articles of Voices of the forest digital series available on:				
	https://ikamexpeditions.com/es/category/serie-digital-voces-del-bosque/				

By September 2022 on Facebook, the main platform, the publications related to the series lead the main statistical indicators of the Ikam Expeditions account. In this sense, 4 of the 6 publications with the highest reach are from Voices of the Forest.

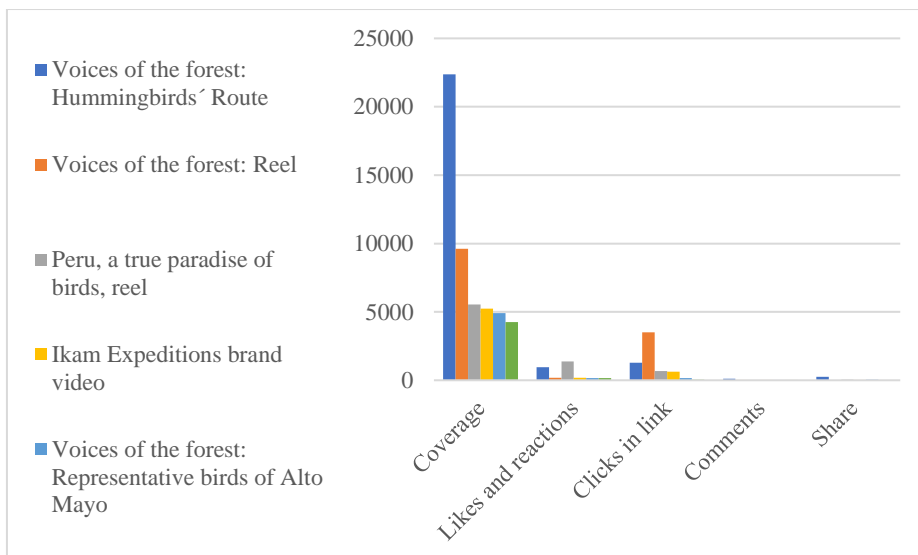


Fig. 1. Social media advertising results of the digital series "Voices of the Forest".

After the release and projection of all the chapters of the series on the social media of the entities mentioned above, "Voices of the Forest" was requested by SERNANP central office to be screened again on its networks and was also very well received. (<https://fb.watch/eAikScBYkj/>).

In addition, a regional open and virtual channel in San Martin, GORESAMTV, screened the series and interviewed a representative of Ikam Expeditions (<https://www.facebook.com/100071172423351/videos/1529370534068337>, from minute 35).

Also, the series was presented at the XI South American Bird Fair, held in the city of Cusco, Peru from October 27 to 30, 2022.

Finally, it is important to underline that the production of the series has showed the company's knowledge and experience in wildlife observation expeditions.

4. CONCLUSIONS

Video-induced tourism contributes to the publicity and positioning of tourist destinations worldwide, as has been shown in this article, particularly wildlife-based tourism.

In this sense, the existence of different audiovisual projects stands out, especially in recent years, projects made by tourism companies specialized in wildlife-related activities, but with less investment, possibly in many cases less experience in audiovisual production and screening and advertising on social media or digital platforms.

In addition, as a result of COVID-19, and due to the paralysis of international tourism, many tour operators and other related businesses began to develop audiovisual material, with the purpose of maintaining contact with their clients, improving marketing strategies or others, and this generated greater audiovisual production such as digital series, virtual programs, and virtual tours that continue.

In this sense, the phenomenon of creation of audiovisual products related to nature tourism is shown as an interesting trend that needs further analysis and this article, as well as the case presented, the series "Voices of the Forest" can serve as input for further audiovisual projects or research.

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Virtual Reality Environment Proposal, CIMAT-Quantum, Zacatecas, Mexico

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Abstract

Nowadays, the use of virtual tours through virtual reality allows for the creation of a recreation of the real world where the user can interact to know different places. In this work, we present the virtual tour of the technology park Quantum Knowledge City in Zacatecas, Mexico. The objective of this application developed under the video game engine Unity3D is to have a means of dissemination that interactively, through 360 images and virtual representations, offers a user experience in which you can learn about the facilities that make up the technological part, get information about the turn of the established companies, in addition to the research of the research centers located in Quantum.

Keywords

Virtual Reality, Virtual tourism, Education

1. Introduction

Nowadays, technology allows for quite interactive representations of places or points of interest for people to get to know using technology. This type of virtual tourism has the advantage that people through devices such as smartphones, computers, and other devices can interact with real-life representations so that they can experience a complete immersion safely and playfully [1].

In recent years, virtual reality has become a means to promote the economic development of various locations. This in turn brings with it several advantages such as the generation of information services, mechanisms for supply and demand of services, and sustainable development [2].

Virtual tourism has had a considerable increase; in the United States alone it is estimated to be worth five billion dollars and it is projected that by 2027 it could exceed 24 billion dollars [3].

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The increase in virtual tourism strategies may be due to the events of a globalized world such as the COVID-19 pandemic, which has drastically changed the way people today use technology to obtain information in various fields, such as work, education, entertainment, and tourism. In this way, virtual tourism is constantly innovating to offer customers experiences in which new technologies and services are integrated [4].

This work presents the proposal for virtual tourism CIMAT-Quantum, City of Knowledge, Zacatecas, Mexico. The purpose of this proposal is to have a virtual environment in which people can get to know the Quantum technological complex, and the different companies, governmental institutions, and public research centers located within it. The purpose of this technological complex is to establish collaboration networks between governmental agencies, educational institutions, private initiatives, society, and environmental protection [5].

In particular, this proposal is oriented to the Centro de Investigación en Matemáticas (CIMAT) which is a public research center integrated into the Sistema de Centros Públicos CONACYT, dedicated to the generation, transmission, and application of specialized knowledge in the areas of mathematics, statistics, and computational sciences [6].

2. Related work

Virtual environments provide a window into experiences abstracted from reality. In the field of tourism these environments can have several applications, such as, in planning and management, marketing and information exchange, entertainment, educational content and accessibility [7]. From a sustainable point of view, virtual environments offer people to have experiences at low cost, with the possibility to access risky and protected places, to have access to remote and difficult to access places, as well as to witness representations of places that in real life are impossible to access [8, 9, 10]. The following are some examples:

- Historical recreations [11, 12]: allows visitors to experience reliable representations of historical sites, learn about and identify characters from history, and witness scenes from history.
- Tourism from home [13]: allows visitors to make trips from home to places such as museums, cities, and presentation sites, from the comfort of a computer or mobile device.
- Accessibility [14]: have access to remote and restricted locations, such as pyramids, government-protected areas, and other constructions.
- Impossible places [15]: allows users to experience from their devices representations of places and events that are difficult to witness in real life, such as the planets, the surface of the moon, witnessing an eclipse, etc.
- Opportunity for disabled tourists [16]: virtual experiences allow users with physical disabilities to carry out tourist activities through technology.
- Sustainability [17]: allows virtual tourism to avoid the deterioration of the environment and at the same time promote the conservation of natural reserves and environments at possible risk.

3. Quantum, Knowledge City

Quantum is a scientific and technological complex that houses private and government research centers to promote the knowledge economy, the training of specialized human resources, and entrepreneurship (see Figure 1) [18].



Figure 1: Quantum, Knowledge City, Zacatecas, Mexico [18].

The new government and private institutions are being added all the time. Currently, we can find within Quantum [19]:

- Metallurgical Research Center.
- Center for Research in Mathematics, Zacatecas Unit.
- Center for Technological Development and Innovation in Telecommunications and Information Technologies for Mining in the State of Zacatecas of the company Lasec Telecomunicaciones S.A.P.I de C.V.
- Innovation Center for the Development of Solutions with Information Technologies, Communications and Software Engineering, Compulogic company.
- Laboratory for Drilling and Rock Support Research.

4. Problem outline

Nowadays, governments and institutions, through the media and technology, are looking for ways to publicize their daily work and promote the benefits and applications of science and technology to students, teachers, and the general public through outreach.

It is important to make known nationally and even internationally what is being done in the sense of scientific development and establish new connections for collaboration. Therefore, everyday strategies are employed through the use of technology in which marketing and promotional experiences can be offered to attract tourists and thus generate new collaboration and business.

In this sense, the use of virtual environments is proposed as a support for dissemination and attraction of new students and researchers to the Mathematics Research Center at Quantum so that they can get to know the graduate programs, professors, facilities, and part of the academic and student life that takes place in this research center.

5. Virtual Environment CIMAT-Quantum

This section presents the proposal of the virtual environment CIMAT-Quantum (see Figure 2), this virtual environment has the purpose of being a window to the outside world to show the Quantum complex to the public.



Figure 2: CIMAT, Zacatecas, Mexico [20].

In this virtual environment, the Center for Research in Mathematics (CIMAT), Zacatecas unit is presented as a first instance. The objective is to provide the user with an immersive experience through CIMAT's facilities, to learn about its undergraduate programs, to get to know the academic and student life within the research center and to provide the user with recreational activities related to the topics carried out at the CIMAT.

For the development of this virtual environment, the steps proposed by Seipel [21] for the development of a virtual environment were taken into account. Each of them is described below.

5.1. Content

The virtual environment starts with a selection of predefined avatars, once the avatar is selected, the user can be moved to the main scenario (see Figure 3). In this scenario, it is intended to show the CIMAT facilities, interact with the professors and perform playful activities within the facilities. In addition, it is possible to tour the entire Quantum complex and learn information about the institutions and companies.

5.2. Objects and Dynamics

For the design of the virtual environment, the Low Poly [22] art type was selected (see Figure 4). This type of art was selected because it is very cartoon-like and visually appealing. Within the virtual environment, there are static 3D models (buildings, some, trees, cars, etc.). These 3D models usually have minimal interaction with the user. On the other hand, dynamic objects are

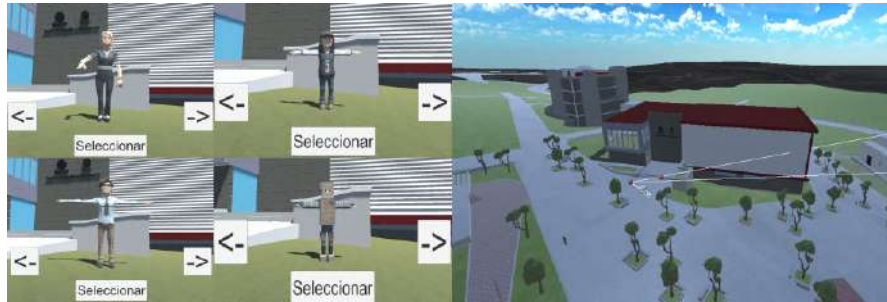


Figure 3: (left) Avatar selection. (right) Main scenario.

those that within the scene will allow the user to perform various actions or interact to perform specified tasks. An example of this is the 360 icons that rotate to show the user the 3D images of Quantum.



Figure 4: (left) Character in Low Poly art. (right) Interactive icon to show 360° images.

5.3. System Implementation

For the implementation of the system, the Unity3D video game engine was used, which allows the compilation of the application on various platforms such as Web, Windows, Mac, and Mobile, among others. Field work was also carried out to take 360° photographs with the Ricoh Theta SC2 camera at various points of the Quantum complex and thus incorporate them into the project so that the user can see them. The 3D models of the buildings and facilities were designed using the Sketchup tool [23] and corrections were made using the Blender tool [24] for their import into the Unity scenario. In Figure 5, a view of the project in Unity and an example of the compiled platform for Web browser are presented.

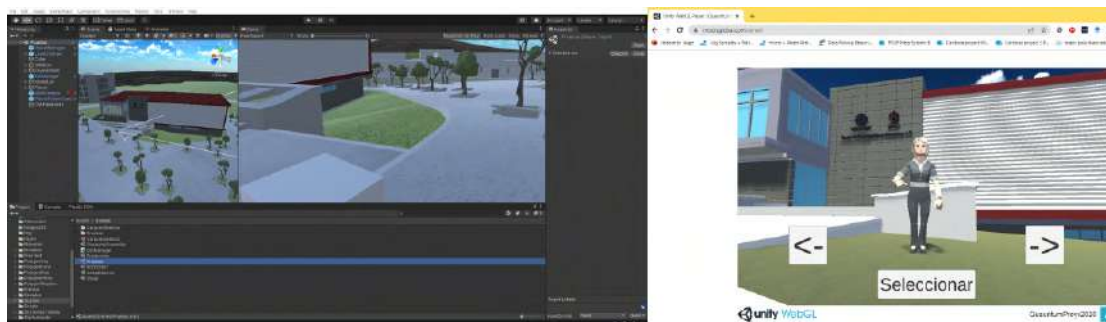


Figure 5: WebGL platform implementation example.

6. Conclusions and Future Work

This work presents the proposal of the virtual environment CIMAT-Quantum, which is proposed as a window to publicize the scientific and academic work being done within CIMAT and also as a means of dissemination of the Quantum technological complex, City of Knowledge, Zacatecas, Mexico.

This work presents an excerpt of the stages that make up its design and development, also emphasizes the interest in having sustainable tourism mechanisms, through the use of technology, and that this tourism can reach a greater number of visitors and thus promote the linkage and business in the region.

The future work is vast, as we continue to work on the design and implementation of various interactive activities within the virtual environment so that users can have a better immersive experience. We are working on a robust design that allows the interaction of several users using different platforms such as mobile devices, virtual reality, and pc platforms. From the user experience point of view, we worked on the design of mechanisms to evaluate the user experience to obtain feedback and make improvements to the system.

7. Acknowledgments

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