Interactive dissemination of 20th century tourist heritage: Integration of ICT for an immersive experience through interior design in Puerto Rico

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Abstract

Interior design in built cultural heritage has undergone a significant evolution in the late twentieth century, going from being contemplative goods of history to elements that require aesthetic, functional and technological adaptation for their conservation and commercial and institutional use. For its part, contemporary architecture is influenced by the development and integration of digital technologies in its processes, which drives a transformation in this field. While in the field of architectural heritage, the importance of disseminating and promoting these assets is highlighted. The dissemination of the architectural and touristic heritage of the 20th century has become a fundamental aspect of the preservation and promotion of cultural heritage. Today, tourism plays a crucial role in the dissemination of this heritage, being the undisputed protagonist in the dissemination of cultural activities and the reception of the public. It has become an essential tool to make known the architectural, historical and cultural richness of different places, attracting local and foreign visitors. Puerto Rico, an island in the Caribbean with a rich cultural heritage history that has witnessed the emergence of the sun and beach tourism phenomenon, and as a result of this, a participant in the development of the hotel industry of the time, allows us to study its hotel architectural heritage developed in the twentieth century and that certainly contributes to the historical reconstruction of them today. It will be the basis for the development of a proposal for the use of Information and Communication Technologies (ICT) for the dissemination of the architectural heritage of tourism in the twentieth century to society.

This research proposes the use of Revit 2024 for the planimetry survey and Twinmotion 2023 software for 3D modelling and historical representation of the Normandie Hotel in Old San Juan. With the purpose of developing a digital historical archive for a possible informative proposal in the Google Arts & Cultue platform, promoting the historical diffusion of the architectural heritage in the visitors of the building and society in general.

Keywords: hotel architecture, interior design, hotel Normandie, architectural heritage, tourist heritage, ICT.

1. Introduction

The present research is framed in the context of previous studies on 20th-century hotel architectural heritage in Puerto Rico and its relationship with interior design, with the objective of exploring how Information and Communication Technologies (ICT) can be effectively implemented in heritage preservation projects in historic hotels in Puerto Rico.

The architectural heritage of 20th-century hotels in Puerto Rico has been the object of interest due to its historical and cultural value. The architecture of these hotels reflects diverse styles and trends of the era, from Art Deco to the Modern Movement, and has witnessed significant moments in the island's history. In addition, the interior design of these hotels has been carefully designed to offer unique experiences to their guests, incorporating elements of the local culture and international influences of the time.

Previous research, such as that conducted by Silva (2015), has analysed the relationship between architectural heritage and interior design, highlighting the importance of considering both aspects in conservation projects. However, the integration of ICT in these projects still represents a little-explored area in the context of hotel heritage in Puerto Rico.

Therefore, this research seeks to fill this research gap by proposing a project that uses ICT as a tool for the preservation and dissemination of the architectural heritage of 20th-century hotels in Puerto Rico. It is intended to develop an interactive digital platform that allows visitors to explore these historic hotels virtually, learn about their history, architecture and interior design, and understand their cultural importance. In addition, we will analyse how these technologies can contribute to the conservation and promotion of these spaces, facilitating their accessibility and dissemination to a wider audience, both locally and internationally.

In summary, this research is part of the continuity of previous studies on the hotel architectural heritage of the twentieth century in Puerto Rico and its interior design. The implementation of ICT as a research project for heritage preservation represents a step forward in the valuation and dissemination of these historic spaces, as well as in the incorporation of technological tools for their conservation and appreciation.

2. Aims and objective

The objective of this research is to document and disseminate the architectural-cultural legacy of Puerto Rico nationally and internationally through the use of digital tools (ICT), with the purpose of developing a historical and interactive archive of the Normandie Hotel in Puerto Rico, thus facilitating access to this emblematic building through Information and Communication Technologies (ICT). The main objective of this project is to generate heritage awareness and to bring the population closer to the importance of preserving and valuing the tourism heritage of the 20th century on the island through innovative technological resources. Being the architectural and historical heritage of the twentieth century in Puerto Rico, a goal of dissemination through ICT, thus causing cultural tourism for Puerto Rico from a heritage perspective.

3. Methodology

Through the analysis of the use of interior design and its relevance in the hotel architectural heritage of the twentieth century, the collection of historical data has been carried out to identify several case studies. These cases have been selected following specific evaluation criteria for their implementation in Information and Communication Technologies (ICT). In this context, the Normandie Hotel in Puerto Rico has been used as the main case study.

The methodology applied in this research has made it possible to achieve the objectives set, demonstrating the importance of interior design in the promotion of tourism heritage. This research is structured in five clearly defined phases that have facilitated its development. Therefore, this research is based on a scientific process, initially through a bibliographic review that includes academic, historical and tourist sources related to the topic

in question. Subsequently, we proceeded to data collection, gathering relevant information on historical buildings, cultural events and the architectural heritage of the island. The selection of case studies is carried out by identifying representative heritage sites of the 20th century in Puerto Rico, following established criteria based on their historical, architectural and tourist relevance. In the analysis and interpretation stage, a comparative study is carried out between the virtual representation and the physical reality of the heritage sites to evaluate the fidelity and usefulness of the virtual tours. In addition, the historical interpretation is deepened to analyse the cultural and touristic impact of the diffusion of 20th-century heritage in Puerto Rico through Information and Communication Technologies (ICT).

These methods and procedures will guide the systematic and rigorous development of research on the tourism heritage of the twentieth century in Puerto Rico, allowing adequate collection, analysis and interpretation of data to achieve the proposed objectives.

4. Interior design and hotel architectural heritage of the twentieth-century

In the context of the 20th century, interior design and architectural heritage have played a crucial role in shaping the cultural and aesthetic identity of several emblematic buildings. This period was characterised by a profound evolution in architectural trends and styles, reflecting the social, political and technological changes of the time. Interior design, as an integral part of architecture, has been a determining element in the creation of spaces that not only fulfill practical functions but also convey symbolic and aesthetic meanings. Throughout the twentieth century, different currents and approaches to interior design have developed and left a definitive mark on the architectural heritage, contributing to the diversity and richness of the built legacy of that era.

Interior design, in its different manifestations throughout history, has become a cultural heritage in itself. This is evident in the evolution of styles and trends that have marked the architecture and interior design of the twentieth century, reflecting the social, technological and cultural changes of the time. In this sense, the implementation of an interdisciplinary approach that links architectural heritage and interior design is presented as a key strategy for the preservation and dissemination of the cultural legacy of this historical period. Only through this comprehensive approach will it be possible to guarantee the conservation and enhancement of these heritage assets in a sustainable manner.
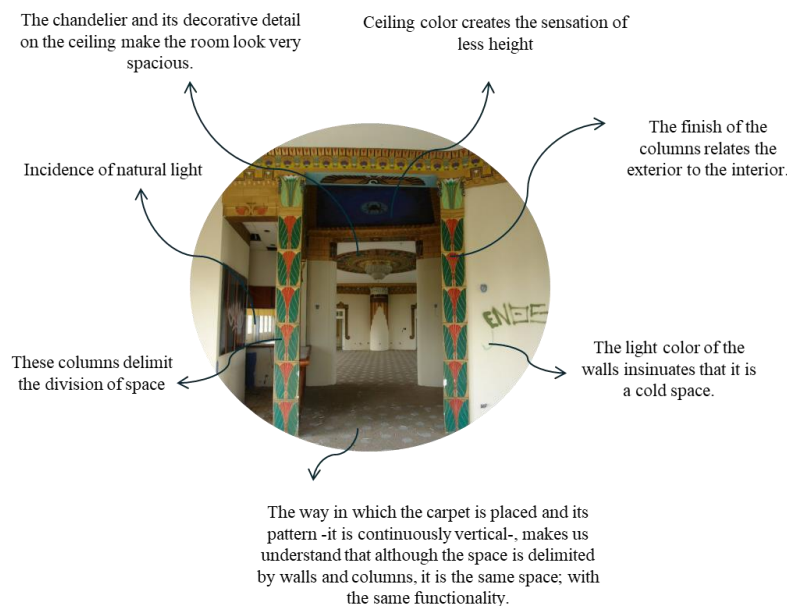

Figure 1. Illustration of the Normandie Hotel's Gold Room illustrating how data can be collected through interior design. Source: Interior Design and Heritage Mutual Contributions (Torres Rosario et al., 2021).

Interior design and hotel architectural heritage have become highly relevant topics in the field of architecture and tourism. This is due to the significant evolution in the styles and approaches used in the creation and preservation of emblematic hotels that represent an invaluable architectural legacy.

Due to the configuration and preservation of the architectural heritage of the twentieth century, at the end of the last century, the vision of cultural heritage was reformed, going from being contemplative assets of history to elements that integrate interior design in spaces (Silva, 2015). The analysis of the links between built heritage and interior design has made it possible to determine that the attributes of the building and the conditioning factors of interior design are closely related in the current context. This implies that the conservation of heritage assets should consider not only the architectural aspects but also the integration of interior design as an integral part of the preservation of the spaces (Silva, 2015). Therefore, hotels and historic buildings should not only be restored and preserved in their original architecture but also in their interior design, thus ensuring the authenticity and stylistic coherence of these spaces that encapsulate the history and culture of an era. The integration of the two thus becomes a powerful tool for keeping history alive and promoting appreciation of the cultural legacy in tourism and contemporary architecture; an example of this can be seen in Figure 1, where the Golden Room of the Normandie Hotel is used for data collection.

"*Given the new postures of society, today, it acquires new habits and behaviours, and with it, new needs are presented. This social-cultural transformation involves our past, our history, our origin. Thus, built heritage and societies are immersed in a state of permanence and innovation*" (Silva, 2015). In this sense, the implementation of an interdisciplinary approach that links hotel architectural heritage and interior design is presented as a key strategy for the preservation and dissemination of this cultural legacy. This is reflected in the incorporation of design elements that highlight the functional, aesthetic, historical, and future uses in a way that reflects the social, technological and cultural changes of the time in a respectful way with the properties.

Consequently, the interior design and architectural heritage of 20th-century hotels represent a rich and diverse history in which styles, trends, functionality and experiences converge. These hotels are or were not only places of lodging but also cultural monuments that reflect the creativity, innovation and history of an era. Their preservation and care continue to be fundamental to understanding and valuing the evolution of architecture and design in the context of tourism and hospitality.

5. ICT in the hotel architectural heritage of the twentieth century

In the field of 20th-century hotel architectural heritage, the implementation of Information and Communication Technologies (ICT) has revolutionised the way in which this historical legacy is preserved, promoted and disseminated. ICTs have made it possible not only to digitally preserve the architecture and interior design of emblematic hotels of this era but also to create interactive experiences and virtual tours that bring visitors closer to the history and beauty of these spaces. Therefore, the integration of digital tools in the hotel architectural heritage of the twentieth century has opened new possibilities for the enhancement and cultural tourism, facilitating access to historical sites in an innovative and educational way.

Despite advances in the use of ICTs for the preservation and dissemination of cultural heritage, the development of specific tools for the enhancement of heritage buildings and historic urban landscapes has been a little explored area so far. As Agüero (2021)[1] points out, this area represents a challenge that demands solid theoretical support that allows it to advance in its implementation in an effective way. The integration of digital technologies such as 3D modelling, augmented reality and interactive platforms in the field of architectural and urban heritage still presents opportunities for improvement and deepening. It is necessary to generate a conceptual and methodological framework to guide the development of innovative technological solutions capable of highlighting the historical,

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[1] "*However, the development of technologies for the enhancement of heritage buildings or historic urban landscapes has been a very little explored area and requires theoretical support that allows further progress for its implementation in this area*" (Agüero, 2021).

cultural and aesthetic value of these heritage assets in a way that is accessible and attractive to the public. Only through this interdisciplinary effort will it be possible to consolidate the use of ICTs as key tools for the preservation and dissemination of the architectural and urban legacy of historical importance[2].

Recently, we are witnessing a remarkable increase in the implementation and use of ICT in the field of cultural heritage. This situation, at the same time, is reinforced by the exponential growth of technologies and cases of applicability in the cultural sector (Ruiz Torres, 2017).

The tools developed by information technologies offer the possibility of actively involving communities from the first steps of any process, not least those related to the protection of cultural heritage. In recent years, the impact of ICT on the cultural sector has grown exponentially. New technologies offer innovative alternatives to create new experiences for a constantly evolving public. Virtual Reality (VR) and Augmented Reality (AR) are positioned as two of the main players in this line that we call 'culture + technology'. Building Information Modelling (BIM) is a collaborative working methodology used in the architecture, engineering and construction industries to create and manage digital representations of the physical and functional characteristics of buildings and other structures as defined (Baraibar et al., 2022), as well as exploring the implication of BIM as a use of collaborative and 3D modelling tools to optimise the design, construction and maintenance of buildings.

In the field of exhibition, the irruption of information and communication technologies offers museums a new opening in the field of interpretation, which can be translated in various ways. In this sense, museums have a significant role to play in the collection of digital images, particularly from different sources, to present and explain the cultural and natural heritage while at the same time having the possibility of communicating with a much wider and more diverse public. On this path, we highlight, as an example, the curricular line defined by Unesco in the museum field, where the main fields of activity of the profession are defined as those represented in the various international committees of ICOM: Specialists in audiovisual media and new technologies.

In this context, new technologies applied to tourism allow better access and a closer approach to these cultural assets, becoming elementary tools for their dissemination (Larrea et al., 2012). Information technologies allow their processing and transmission, mainly through computers, the Internet and telecommunications (Larrea et al., 2012). Advances in virtual reality, for example, enable immersive tours of historical and archaeological sites from anywhere in the world, offering users a unique sensory experience. Likewise, mobile applications and online platforms facilitate access to interactive tourist guides enriched with historical and cultural data, which enhance the understanding and appreciation of these heritage assets. This convergence of technology and tourism not only democratises access to culture but also contributes to the preservation and enhancement of these assets for future generations.

True technological transformation goes beyond simply having new tools, as pointed out by Larrea et al. (2012). It is also about the ability to manage and apply these technologies effectively, which generates diverse territorial realities in the field of cultural tourism. The adoption and appropriate use of Information and Communication Technologies (ICT) can create enriching and sustainable tourism experiences in certain regions, while in others, there may be a digital divide that limits access to these advantages. This phenomenon can be clearly observed in tourism destinations where digital infrastructure and technology training are robust, allowing the creation of interactive applications, virtual tours and immersive experiences for visitors. In contrast, areas with poor connectivity and limited resources may face difficulties in taking full advantage of the opportunities offered by ICT in the field of cultural tourism. Therefore, the real transformation lies not only in the availability of advanced technologies but also in the capacity of communities and destination managers to implement them effectively and equitably, thus ensuring the cultural and tourism development of different territories.

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[2] "*Tourism-oriented mobile applications and the implementation of augmented reality for the enhancement of architectural heritage can become a new channel that enables tourism information, development and marketing in a more efficient and innovative way*" (Agüero, 2021).

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The integration of ICTs in the field of tourism and heritage becomes an essential means to disseminate the historical, cultural and social value of these works and manifestations, as pointed out by Larrea et al. (2012). These allow a wide and accessible dissemination of information, facilitating awareness and understanding of the importance of these cultural assets. Through mobile applications, online platforms and augmented reality tools, visitors can access narratives enriched with historical and contextual data while exploring monuments, archaeological sites or cultural manifestations. This digital interaction fosters a deeper appreciation of cultural and heritage diversity while promoting preservation and respect for these manifestations that enrich our collective identity.

This topic has been the subject of reflection since the 20th century, and today, cultural heritage is facing a changing and complex context in which precepts on a global scale must be considered. In this scenario, cultural heritage management acquires crucial importance when trying to adapt enhancement initiatives to meet the demands of the macro environment (Lerrea et al., 2012). ICTs are presented as essential tools in this work, allowing a more efficient and dynamic management of heritage. Through geographic information systems, interconnected databases and online platforms, heritage managers can effectively monitor, preserve and promote the cultural assets of a city. These technologies facilitate the identification of areas at risk, the planning of conservation actions and the dissemination of cultural wealth in a more accessible and attractive way for residents and visitors. Thus, the combination of ICT and cultural heritage destinations seeks to adapt to a constantly evolving global environment while enriching and strengthening a city's cultural identity for future generations.

In conclusion, the relationship between ICT and cultural heritage in heritage environments has evolved to become a fundamental pillar in the management and dissemination of our cultural legacy. They offer powerful tools to adapt heritage enhancement initiatives to current demands. The combination of geographic information systems, interconnected databases and online platforms not only enables more efficient heritage management but also enriches the experience of residents and tourists by offering a deeper and more accessible understanding of a city's history and culture. This synergy between ICT and cultural heritage is not only essential for the preservation of our cultural identity but also contributes to the sustainable development of cities, promoting responsible tourism and the appreciation of our cultural diversity.

6. Hotel Normandie, Puerto Rico – Case study

The Normandie Hotel, shown in Figure 2, was inaugurated on October 10, 1942, in San Juan, Puerto Rico. It has a rich and fascinating history, and it has been included in the National Register of Historic Places since 1980[3]. It stands out for its design, inspired by the French ocean liner SS Normandie. Between 1939 and 1942, artists from France, Spain, the Dominican Republic and Puerto Rico participated in the hotel's ornamentation, the cost of which was significant. Throughout the years, it has witnessed changes and transformations, from being an emblematic place of tropical nightlife in the 1930s to facing challenges and changes in its structure and use over time. Despite its ups and downs, the Hotel Normandie remains an important symbol of Puerto Rico's architectural and historical heritage, with a presence that evokes nostalgia and timeless beauty in the city of San Juan.

This building is an example of Art Deco on the island, being one of the few luxury hotels of the time; this is rooted in the celebrations of social and political activities that made this building one of great historical and sentimental value for several generations of Puerto Ricans. The forms of the Normandie represent movement, modernism and technology, while its interior was decorated with Egyptian-inspired motifs: lotus flower capitals, murals with Egyptian scenes and friezes with zigzag motifs, all polychrome and adorned with gold leaf details. The main halls were decorated with polychrome plasterwork, tiles, lamps, mahogany furniture, murals, mirrors and all kinds of ornamentation in the Art Deco style. Thanks to the *Salón de Oro*, *Salón de Plata* and *Salón Victoria*, it was eventually compared to a palace (Puerta de Tierra, 2024).

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[3] Properties of Puerto Rico National Registry of Historic Places National Park Service U.S. Department of the Interior State Historic Preservation Office Office of the Governor San Juan, Puerto Rico Revised. (2012).

Figure 2. Exterior of Hotel Normandie 2011. Source: Historical Building Drawing Society of Puerto Rico.

The building has a triangular floor plan with rounded corners, consisting of seven floors organised around an inner courtyard and a basement. The lobby was small and included the restaurant. On the first level, there was a swimming pool -which was eventually covered-, commercial areas, storage rooms, rooms, stairways and elevators in the northeast and southeast corners. The sixth floor contained a ballroom known as the Salón de Oro and a banquet hall known as the Salón de Plata. The same floor contained a dining room with a kitchen and a large hall that was used as a casino. Finally, the seventh floor contained large rooms, a kitchen and a dining room (Puerta de Tierra, 2024).

Throughout the 1960s, the Normandie was closed and abandoned, and by 1976 it was foreclosed. However, it was restored in the early 1990s, and several years later closed its doors again due to damage caused by Hurricane Georges. It was not until 2005 that it reopened its doors after an extensive and costly remodelling. This brought with it the installation of two large aquariums in order to give a touch of the sea to the new Atrium Café; in addition, in all rooms, guests had a work area with a desk and broadband and internet connection (Puerta de Tierra, 2024).

Certainly, the Normandie had many days of glory since its opening, as well as many more of tragedy and eviction. Today, the Normandie remains closed after several attempts to open, and some projects are in the pipeline to give new life to this emblematic building on the island. Given the several reopenings and remodellings to keep the hotel adapted to the new trends of the time during the time of opening, the hotel underwent some significant aesthetic modifications that allowed it to maintain the initial essence in a timeless way. These modifications have allowed us to gather historical and aesthetic data and, of course, to understand the functionality of the spaces beyond their initial configuration.

Within the framework of this research and preservation project of the hotel architectural heritage of the 20th century, the Normandie Hotel in Puerto Rico becomes an emblematic case study. Through the use of tools such as Revit 2024 for 3D modelling and planimetric survey, Softword Twinmotion 2023 for real-time visualisation and simulation, and the creation of a digital historical archive through the Google Arts & Culture platform, we seek not only to document and preserve the history and unique architecture of this hotel but also to disseminate its cultural legacy in an innovative and globally accessible way. This integrated approach of advanced technologies and digital platforms will enable a detailed and immersive representation of the Hotel Normandie, preserving its historical and architectural significance for present and future generations.

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Although it is currently closed, this project will make it possible to maintain a digital historical archive of the building and thus provide an effective guide for its future conservation as soon as a rehabilitation and restoration proposal is proposed, focused on maintaining its current use or modifying it for a new use.

7. Preliminary results - preservation project (ICT)

The preliminary results of the ongoing research in relation to the heritage preservation project of the Normandie Hotel in Puerto Rico highlight the potential of Information and Communication Technologies (ICT) in the documentation and exhibition of the hotel's architectural heritage of the twentieth century. This study has implemented the use of tools such as Revit 2024, Twinmotion 2023 and the Google Arts & Culture platform in order to develop an interactive digital historical archive that will allow a detailed virtual exploration of the hotel, its architecture and interior design.

Through the collection of relevant information on the Normandie Hotel, the proposal is to develop a historical heritage archive using the Google Arts & Culture platform that will allow it to reach the whole society so that the Hotel can be accessed during a historical tour from its beginnings, its current situation of abandonment and possible rehabilitation of it in the future. Figure 3 shows a graphic proposal of what this proposal would look like if developed under the aforementioned platforms.
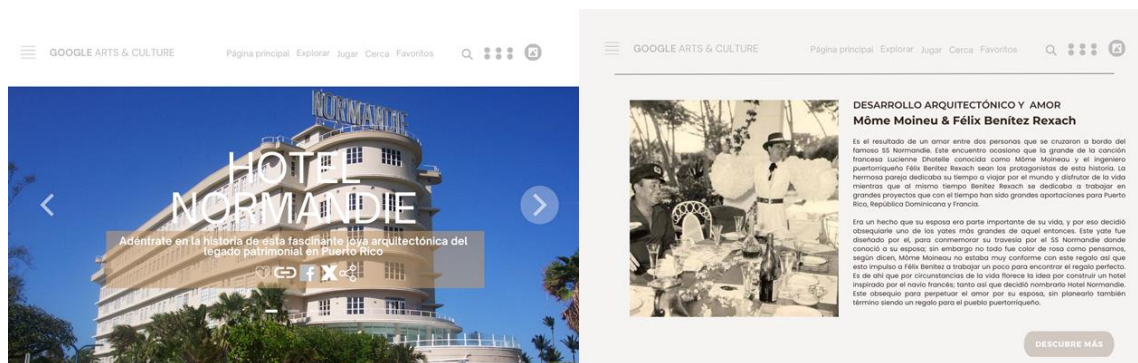

Figure 3. Visual proposal of the historical archive of the Normandie Hotel. Own elaboration.

Given the main idea of making a historical tour of the Normandie Hotel to know who its founders were, how it came about and related issues, we proceed to Figure 4, which contains a graphic representation of a timeline that will guide visitors to understand the history of the property and continue this through images of the interiors of the same, revealing the transformations and interior modifications that has experienced the property during its time in operation, as well as the natural modifications that has the mime due to its state of abandonment due to its closure.
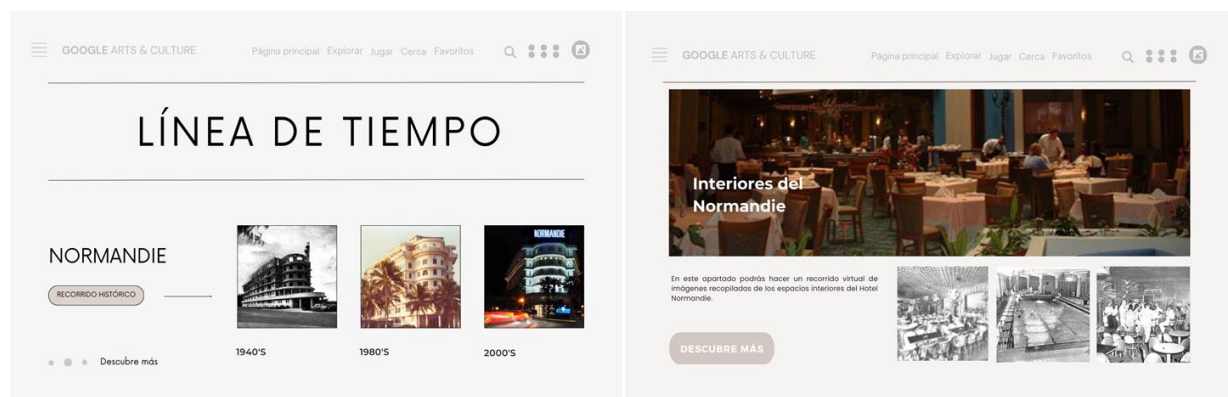

Figure 4. Visual proposal, photographic and historical section. Own elaboration.

Moving forward in the development of this proposal, Figure 5 shows how two sections have been created to implement the use of software for the collection of planimetric data, the compilation of the initial state of the building and its transformations. This will make it possible to obtain an architectural file and database of the building, as well as to attract the participants to a virtual tour through a 3D representation of the building.
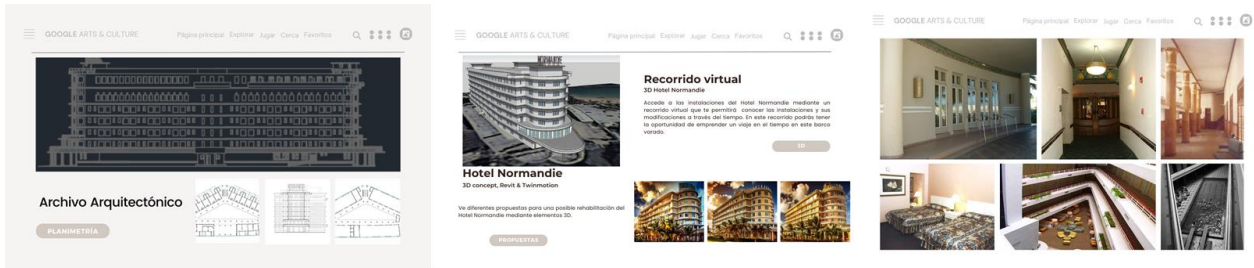

Figure 5. Visual proposal, architectural section, use of 3D software and interior data. Own elaboration.

Finally, in Figure 6, we can see three sections related to the exhibition and approach to heritage information such as the technical file related to the National Register of Historic Places to which it belongs since 1980, journalistic information, forums in which the property has been discussed and magazines, posters and other relevant graphic information that allows us to continue to expose its architectural, historical and heritage value. Last but not least, a section is created in which you can see the hotel's location for all those who are in other countries and wish to locate this wonderful property.

This graphic proposal will serve as a guide to meet the objectives set out in this research and thus offer a heritage legacy for all and lasting.

Figure 6. Visual proposal, heritage section, historical archives, location and navigation. Own elaboration.

8. Conclusions

The potential of ICTs, social networks, and digital tools related to heritage has been at the centre of the studies of many researchers since their origin, mainly related to their possibility of creating a virtual "showcase" or offering parallel or alternative experiences to the heritage property. In these cases, the effects of ICT are considered highly positive in the process of strengthening cultural identity.

The preliminary results of this project have demonstrated the effectiveness and versatility of using BIM software for the collection and reconstruction of heritage properties. Likewise, the integration of Google Arts & Culture would certainly enrich the process of patrimonialisation of 20th-century hotel architecture, specifically the Hotel Normandie in Puerto Rico, by offering exhibition and interactive storytelling functions, allowing users to explore the history, interior design and architectural details in an immersive and educational way.

This innovative approach to her documentation and exhibition of the hotel's architectural heritage has yielded promising results in the valorisation and dissemination of the history and architecture of the Hotel Normandie. In the future, it will allow users to access this emblematic hotel virtually, explore its spaces, learn about its history and appreciate its interior design and modifications from anywhere in the world.

Therefore, these results suggest a great potential for the use of ICT, in particular through Revit 2024, Twinmotion 2023 and Google Arts & Culture tools, in the preservation and promotion of 20th-century hotel architectural heritage, not only for Puerto Rico but also in other similar historical and cultural contexts.

In conclusion, this research focused on 20th-century hotel architectural heritage, interior design and the implementation of Information and Communication Technologies (ICT) for its dissemination, preservation and conservation, specifically in the Hotel Normandie in Puerto Rico, has revealed the relevance and positive impact of the integration of these digital tools in the management of the architectural legacy. The combination of Revit 2024, Twinmotion 2023 and Google Arts & Culture has enabled detailed documentation, a visually appealing presentation and global dissemination of the Hotel Normandie, enriching the experience of virtual visitors and strengthening the cultural identity associated with this emblematic space. These findings underscore the importance of continuing to explore and leverage ICTs as allies in the preservation and valorisation of architectural heritage, not only as technological tools but also as a means to foster appreciation, knowledge and conservation of these architectural treasures for generations to come.

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