

## Virtual Reality's influence on Sicilian tourists' engagement with Romanian ecotourism

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### Abstract

This study investigates the impact of Virtual Reality (VR) on the travel intentions of Sicilian tourists toward Romanian ecotourism destinations, particularly focusing on the role of VR's authenticity. Employing a quantitative methodology and Structural Equation Modeling, the research analyzes how the Theory of Innovation Diffusion applies to tourists' perceptions collected through an online survey. The study involves 97 Sicilian participants and measures five key constructs, including innovation diffusion attributes (simplicity, compatibility, and benefit), authentic experience, and behavioral intentions. Findings reveal that while innovation diffusion attributes do not directly influence behavioral intentions, the authentic VR experience fully mediates this relationship. In other words, the perception of authenticity in VR simulations plays a significant role in translating technological attributes into actual travel intentions. This research contributes to VR tourism literature by highlighting the importance of authenticity in VR adoption and its specific impact on a culturally aligned tourist market. Practical implications suggest that tourism marketers should focus on enhancing the immersive quality and authenticity of VR applications to effectively convert virtual engagements into actual visits. Strengthening the realism of VR experiences could bridge the gap between virtual exploration and physical travel, offering strategic insights for targeting markets like Sicilian tourists. This approach can significantly influence tourists' travel behavior, providing valuable insights for promoting Romanian ecotourism destinations.

### Keywords

Virtual Reality, ecotourism, authenticity, behavioral intentions, Innovation Diffusion Theory, tourism marketing

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### Introduction

The integration of Virtual Reality (VR) into the marketing strategies of ecotourism destinations represents a transformative approach to promoting sustainable tourism practices globally. Romanian ecotourism destinations, with their diverse natural landscapes and rich cultural heritage, provide an ideal setting for the application of VR technologies. Despite the increasing use of VR as a marketing tool, there is a significant gap in understanding how specific demographic segments, such as Sicilian tourists, perceive and respond to these virtual portrayals. This focus is particularly pertinent as Sicilian tourists represent a vital potential market for Romanian ecotourism, owing to their geographic proximity and historical interest in Eastern European cultures.

Research has shown that VR transcends traditional marketing mediums by offering immersive experiences that simulate physical presence in remote environments, potentially transforming tourist behavior and preferences (Guttentag, 2010). The Theory of Innovation Diffusion (Rogers, 1983) is essential in understanding how innovations like VR are adopted, suggesting that attributes such as simplicity, benefits,

and compatibility significantly influence the adoption rate of new technologies. This framework is important for understanding how VR might enhance the appeal of Romanian ecotourism to international tourists, including those from Sicily. More, authenticity in VR experiences, which involves creating realistic and engaging simulations, is important for ensuring that these technologies are not only adopted, but also effective in promoting actual travel to the destinations they depict. Studies suggest that the perceived authenticity of VR experiences can significantly influence how tourists interact with this technology, impacting their satisfaction levels and subsequent travel behaviors (Hassan and Rahimi, 2016; Kim et al., 2020a). Despite VR's potential, there is scant research focusing on the perceptions of Sicilian tourists toward Romanian ecotourism destinations through VR. This oversight is significant because cultural background profoundly affects technological receptivity and the interpretation of authenticity in virtual environments.

This study aims to bridge this gap by examining how VR influences the travel intentions and destination choices of Sicilian tourists considering Romanian ecotourism sites. Employing a quantitative method, this research will draw on the principles of the Innovation Diffusion Theory to assess how perceived attributes of VR technology - especially authenticity - impact the decision-making processes of Sicilian tourists.

By systematically exploring these dynamics, this study will significantly enrich the academic literature on VR in tourism and provide practical insights for marketers and policymakers aiming to leverage VR technology. Specifically, the findings will assist in tailoring VR content to better align with the cultural expectations and preferences of Sicilian tourists, potentially leading to increased interest and visitation rates to Romanian ecotourism destinations. This approach underscores the necessity of integrating authentic experiences in VR to enhance its effectiveness as a marketing tool, ensuring that virtual visits potentially translate into actual travel.

## **1. Literature review**

### **1.1. Theoretical framework: Theory of Innovation Diffusion**

The Theory of Innovation Diffusion, pioneered by Everett Rogers (1983), provides a framework for understanding how innovations, such as VR, are adopted within a social system. This theory explores how the attributes of simplicity, benefit, and compatibility are instrumental in driving consumer adoption of information technology. The research of Lu and Hsiao (2022) on VR shopping platforms uses the Theory of Innovation Diffusion to determine how technological characteristics like relative advantage and compatibility influence customer satisfaction and flow experience, which are essential for the adoption of VR in tourism contexts. Their findings highlight the significant impact these attributes have on enhancing consumer engagement and purchase intentions, applicable also to VR ecotourism experiences. Furthermore, Hassan and Rahimi (2016) applied the Theory of Innovation Diffusion to explore how augmented reality (AR), a technology similar to VR, is adopted in tourism marketing. Their analysis underscores the importance of simplicity, benefit, and compatibility in facilitating the adoption of technological innovations, offering insights that are equally applicable to VR in ecotourism. In the realm of VR tourism, Kim et al. (2020a) utilized both the Innovation Diffusion and Uses and Gratifications theories and emphasized how attributes such as simplicity, benefit, and compatibility not only enhance the authentic experience and subjective well-being but also positively influence behavioral intentions toward VR tourism. This indicates a strong relationship between the perceived attributes of the innovation and the readiness of consumers to adopt VR technology also in ecotourism.

### **1.2. Authentic experience in VR**

An authentic experience in VR is crucial for its effectiveness in the tourism industry, as it determines how genuinely users perceive VR simulations to be true-to-life (Gilbert, 2016). Such experiences are significant in replicating real-world tourism scenarios, enhancing user satisfaction, and fostering the continuous adoption of VR technology. Authentic VR aims to fully immerse users by providing a sensory-rich, interactive, and emotionally engaging environment that closely mirrors actual destinations (Mura et al., 2017). Guttentag (2010) highlights VR's potential in various aspects of tourism including planning and heritage preservation, noting its role in simulating authentic experiences that could substitute physical visits to sensitive locations. Furthermore, the stimulus-organism-response (SOR) model shows that authentic VR experiences shape cognitive and affective responses, which are vital for increasing user attachment and intention to visit the depicted locations (Kim et al., 2020b), emphasizing the need for realistic and engaging content in VR ecotourism. In the same vein, other research builds and tests a framework based on innovation diffusion and uses and gratifications theories. It highlights how the authentic experience in VR tourism, moderated by tourists' technology readiness, significantly affects their subjective well-being and behavioral

intentions (Kim et al., 2020a), therefore offering insights that are equally applicable to VR in ecotourism. Furthermore, the paper of Suprpto et al. (2023) explores VR's potential to replace actual travel experiences during travel restrictions like those during the COVID-19 pandemic. It examines how presence and authenticity in VR affect tourists' experiences, concluding that while VR enhances tourism promotion, it does not fully substitute for real travel experiences. Their results are equally applicable to VR in ecotourism. More, Schipou et al. (2021) delve into how perceived authenticity in virtual VR applications has become essential for enhancing tourist experiences, particularly in the context of travel restrictions imposed by the COVID-19 pandemic. The study reveals that higher perceived authenticity in VR tourism significantly influences tourists' willingness to engage with VR as a viable alternative to physical travel, underlining the importance of delivering realistic and engaging virtual experiences during and beyond the pandemic. These studies collectively suggest that while VR can enhance the ecotourism experience by offering realistic, immersive simulations, the authenticity of these experiences plays a significant role in their effectiveness and is an essential variable in understanding VR tourist behavior.

### **1.3. Behavioral intention of VR Sicilian tourists to engage in travel to Romanian ecotourism destinations**

The adoption of VR in tourism has prompted a closer examination of behavioral intentions related to its use, particularly concerning the inclination to visit real-world destinations after experiencing them virtually. Kim et al. (2020a) findings emphasize that authentic experiences and enhanced subjective well-being significantly influence the intention to visit real places featured in VR. This study provides a comprehensive look at how VR can motivate tourists to transition from virtual exploration to actual visits. Furthermore, Sobarna (2023) discusses the impact of content and system quality on visitors' behavioral intentions, including the likelihood of recommending VR tourism experiences. This study indicates that high-quality VR content is essential in encouraging users to recommend VR experiences to others. Jorge et al. (2023) investigate how the destination image perceived through VR influences place attachment and behavioral intentions, including the intention to invest time and money in visiting the actual destinations. Their findings highlight the role of cognitive and affective dimensions of destination image in fostering such investments. Wang et al. (2022) explore the effects of VR tourism involvement on place attachment and behavioral intentions. They found that engagement with VR tourism content significantly influences users' willingness to share positive experiences and promote the destinations they visited virtually. The results of these articles are also relevant to VR ecotourism experiences. Understanding the behavioral intentions associated with VR in ecotourism is essential for tourism marketers and destination managers aiming to leverage VR technology effectively. By focusing on enhancing the authenticity of VR experiences, stakeholders can significantly influence tourists' intentions towards actual visits, thereby bridging the gap between virtual exploration and physical ecotourism.

### **1.4. Development of hypotheses**

#### **1.4.1. Innovation diffusion and authentic experience in VR**

Guttentag (2010) discusses the potential of VR to serve as a tool for heritage preservation and tourism marketing, highlighting that the simplicity of VR interfaces, one innovation diffusion attribute, makes it easier for users to engage with the technology, thereby enhancing the perceived authenticity of the virtual experience. Rainoldi et al. (2018) focus on VR as an innovative tool in destination marketing. The study highlights how the benefits - another innovation diffusion attribute - of VR, such as providing immersive previews of destinations, influence potential tourists' decision-making processes by enhancing their ability to form realistic expectations and detailed destination images, thus increasing the perceived authenticity of the marketed experience. Pešteek and Sarvan (2020) discuss recent trends in VR that have changed how the tourism and hospitality industry communicates offerings to meet evolving tourist needs. The study highlights that VR's compatibility - other innovation diffusion attribute - with current technological trends and consumer behavior is essential in delivering realistic virtual travel experiences that tourists perceive as authentic. Based on these studies offering insights that are equally applicable to VR in ecotourism, we suggest that characteristics of innovations are essential in shaping VR consumers' perceptions of the authenticity of experiences within the ecotourism sector. Therefore, we posit the following hypothesis:

Hypothesis 1 (H1): Attributes of innovation diffusion have a positive effect on VR travelers' perceptions of the authenticity of their experiences.

#### **1.4.2. Innovation Diffusion and behavioral intention of VR Sicilian tourists to engage in travel to Romanian ecotourism destinations**

Kim et al. (2020) explores how various attributes of innovation diffusion such as simplicity, benefit, and compatibility influence tourists' intentions to use VR in tourism. The study highlights that these attributes

significantly enhance the perceived authenticity and subjective well-being of VR experiences, which in turn positively influences behavioral intentions to engage further with VR tourism and potentially visit the actual places seen virtually. Lu and Hsiao (2022) analyzes how diffusion of innovations theory can be applied to VR environments. Though focused on shopping, the findings are applicable also to ecotourism, as they discuss how increased spatial presence and flow, facilitated by innovation attributes, enhance the satisfaction and subsequent behavioral intentions of users. These outcomes suggest similar effects could be also observed in VR ecotourism settings, where enhanced spatial presence could encourage users to visit the actual ecotourism sites they explore virtually. Hassan and Rahimi (2016) provides insights into how the diffusion of innovative AR technology influences tourism marketing. This study’s conclusions about AR’s influence on consumer behavior can be extrapolated to VR in ecotourism, where the successful diffusion of VR innovations could similarly drive the intention to visit real-world counterparts of virtually experienced locations. Drawing on these insights, we can formulate:

Hypothesis (H2): Attributes of innovation diffusion (simplicity, benefit, compatibility) in VR positively influence tourists' behavioral intentions to use VR in ecotourism, including their intentions to visit actual ecotourism sites that they explore virtually.

**1.4.3. Authentic experience and behavioral intention of VR Sicilian tourists to engage in travel to Romanian ecotourism destinations**

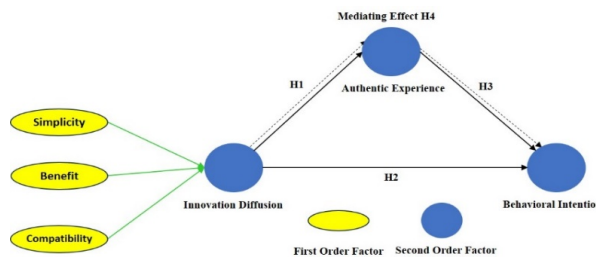
Authentic experiences in VR tourism are influenced by innovation attributes like simplicity, benefit, and compatibility, as well as gratification attributes such as informativeness and playfulness. These factors impact subjective well-being, which then positively influences behavioral intentions more than authentic experiences alone (Kim et al., 2020a). Additionally, authentic VR experiences affect cognitive and affective responses, which are crucial mediators influencing attachment to VR and the intention to visit destinations showcased in VR (Kim et al., 2020b). Schiopu et al. (2021) emphasized the importance of authenticity in shaping behavioral intentions to use VR in tourism, particularly during the COVID-19 pandemic. Their study shows that perceived authenticity in VR significantly determines its substitutability for real-life travel, impacting users' intentions to adopt VR as an alternative to traditional travel under pandemic restrictions. Moreover, authenticity in VR can vary widely, incorporating constructivist, subjectivist, and existentialist perspectives, which affect the perception and effectiveness of VR in heritage conservation and tourism (Vichnevetkaia, 2021). Drawing from these findings, it is evident that:

Hypothesis (H3): Authentic VR experiences positively influence the behavioral intentions of VR tourists to engage in travel to ecotourism destinations.

**1.4.4. Authentic experience as mediator between attributes of innovation diffusion and behavioral intention in of VR Sicilian tourists to engage in travel to Romanian ecotourism destinations**

The role of authentic experience in VR as a mediator is highlighted by several studies focusing on how perceived authenticity impacts user engagement and behavioral intentions. Kim et al. (2020a) and Kim et al. (2020b) found that authentic experiences enhance cognitive and affective responses and mediate the relationship between technology attributes (such as simplicity, benefit, compatibility) and the intention to visit VR-presented destinations. These studies emphasize that enhancing the authenticity of VR experiences significantly influences ecotourists' engagement and their intentions to visit real-world destinations presented virtually. Similarly, Gilbert (2016) also notes the importance of authenticity in determining the perceived realism of virtual environments, affecting users' behavioral intentions. Drawing on the findings of these studies, which are relevant to VR applications in ecotourism, we propose the following:

Hypothesis (H4): Authentic VR experience mediates the relationship between attributes of innovation diffusion theory and behavioral intentions of VR Sicilian tourists to engage in travel to Romanian ecotourism destinations.



\*Note: Green lines are formative indicators and bold lines are hypotheses. Dotted lines denote mediated role (H4).

**Figure no. 1. Proposed research model**

Source: Developed by authors

## 2. Methodology

### 2.1. Measurements

This study uses multi-item measures to mitigate the drawbacks of single-item measures, incorporating 19 items to evaluate five key concepts: simplicity (SI), compatibility benefit (BE) and (CO) - attributes of innovation diffusion (ID) -, along with authentic experience (AUT) and behavioral intention (INT). The two indicators used to assess SI were taken from earlier research, including works by Agag and El-Masry (2016) (e.g., “I find it easy to get what I want when I use VR related to ecotourism.”). Additionally, four measures for BE were developed based on previous studies, such as those by Al-Jabri and Sohail (2012) (e.g., “Using VR related to ecotourism is useful for gathering information.”), and the assessment of CO was based on four questions sourced from a prior study by Robertson (1967) (e.g., “Using Virtual Reality related to ecotourism fits well with my way of living.”). AUT was assessed using four items derived from studies conducted by Kim et al. (2020a) (e.g., “Using Virtual Reality related to ecotourism has provided me with authentic experiences”), while for measuring BI was using five items from Kim et al. (2020a) - assess planning, intent to visit, willingness to invest, and recommending visits. The questions were assessed using 7-point Likert-type scales. The questionnaire was initially created in English and subsequently translated into Italian by two bilingual professionals. Following this, it was translated back into English, and any discrepancies identified were revised.

### 2.2. Data collection

With the development of the internet, some hospitality and tourism researchers are using online surveys to reach wider populations of interest effectively (Kim et al., 2020b). This study used data collected by an online survey platform (Google Forms), and addressed potential Sicilian tourists. 97 questionnaires were collected and codified for analysis. The study data were collected between 05 February 2024 - 10 April 2024. The survey included questions on participants' demographic and social details, such as gender, age, and education, measured using scales. Although the sample size of 97 participants might seem small, it is adequate for this study. Similar research on digital experiences in tourism has successfully used small samples, such as Huang et al. (2012) with 42 participants, yielding significant insights. Additionally, according to G Power software, for a study with a significance level of 0.05, a large effect size of 0.35, a power level of 0.8, and 5 variables, the required sample size is 43 participants (Cohen, 1988). Therefore, our sample size of 97 not only meets but exceeds this threshold, confirming its viability.

### 2.3. Data analysis

The data were analyzed using SmartPLS 4.1.02 (Ringle et al., 2015). Partial least squares-structural equation modeling (PLS-SEM) was utilized to evaluate the statistical significance of the influence of independent variables on dependent variable. Chin et al. (2003) noted that the criteria PLS-SEM tend to be less stringent regarding measurement scales, sample size, and residual distributions compared to covariance-based SEM (CB-SEM). In the PLS-SEM approach, formative and reflective indicators are analyzed concurrently (Chin et al., 2003). As a first step in assessing the measurement model, confirmatory factor analysis identified the structure of systematically measured factors and variables in underlying constructs. This reduced multicollinearity or correlations of error variance between indicators. Structural equation modeling used a two-step hybrid method by specifying a measurement model in the analysis of confirmatory factors and testing a latent structural model developed from the measurement model (Kline, 2005).

## 3. Results

### 3.1. Respondents profile

The proportion of male and female respondents was 52.6% and 47.4%. The largest group, with 46 individuals from Generation Z, which represents 47.42% of the sample, followed by the Millennials, also known as Generation Y, with a portion of 30.93% of the total respondents. 30.9% of participants have a high school diploma, 29.9% hold a bachelor's degree, another 29.9% have a master's degree, and the remainder possess PhD degrees.

### 3.2. Measurement model

Confirmatory factor analysis was conducted on the measurement model as per Hair et al. (2006). One item from the simplicity construct was removed due to their factor loadings being below 0.5 (Kline, 2005). As detailed in Table 1, 19 items were retained for analysis. Next, reliability and validity assessments were conducted. Initially, Cronbach's alpha for internal consistency reliability showed that all values surpassed

the recommended threshold of .700 (Hair et al., 2006). Additionally, composite reliability (CR) tests confirmed internal consistency across measurement items, with all values exceeding the .600 guideline and ranging between .715 and .980 (Ringle et al., 2018). For convergent and discriminant validity, the average variance extracted (AVE) values were computed, all exceeding the minimum recommended value of .50, ranging from .764 to .926. Furthermore, all squared AVE values were higher than the correlations between any pair of constructs (Fornell and Larcker, 1981). Thus, the measurement model's reliability and validity are robustly supported.

**Table 1. The results of measurement model (n=97)**

Variable	AUT	CO	INT	SI	BE	Factor loading	Cronbach's $\alpha$	CR	AVE ( $\sqrt{\text{AVE}}$ )
<u>AUT</u>							0.964	0.973	0.902
AUT1						0.920			(0.950)
AUT2	1					0.958			
AUT3						0.969			
AUT4						0.950			
<u>CO</u>							0.973	0.980	0.926
CO1						0.933			(0.962)
CO2	0.796	1				0.970			
CO3						0.986			
CO4						0.960			
<u>INT</u>							0.980	0.984	0.925
INT1						0.945			(0.962)
INT2						0.974			
INT3	0.775	0.608	1			0.921			
INT4						0.986			
INT5						0.981			
<u>SI</u>							0.715	0.873	0.775
SI1	0.873	0.840	0.733	1		0.842			(0.867)
SI2						0.917			
<u>BE</u>							0.898	0.928	0.764
BE1						0.889			(0.874)
BE2						0.875			
BE3	0.807	0.684	0.686	0.860	1	0.871			
BE4						0.861			

Source: Developed by the authors based on calculations from SmartPLS

ID is measured as a formative variable with three sub-constructs. This formative approach facilitates the identification of multiple characteristics, each encompassing several dimensions. Therefore, ID was the Second Order Factor (SOF) in the study based on three First Order Factors (FOF) as SI, BE and CO. In order to establish the SOF validity were checked outer weights, *t* Statistics, *p* values, outer loadings and VIF (see Table 2). The outer loadings were found significant (Hair et al., 2006). Furthermore, outer loadings were found greater than 0.50 for each of SOF (Sarstedt et al., 2019). Finally, VIF value were assessed to check collinearity, all VIF values are less than the recommended value of 5 (Hair et al., 2006). Since, all criterion are met, SOF validity was established.

**Table 2. Second Order Factor (SOF) Validity**

SOF	FOF	Outer Weight	<i>t</i> Statistics	<i>p</i> Values	Outer Loadings	VIF
ID	SI	0.174	0.938	0.348	0.880	3.256
	BE	0.497	2.763	0.006	0.919	2.777
	CO	0.440	4.083	0.000	0.885	2.095

Source: Developed by the authors based on calculations from SmartPLS

### 3.3. Structural model

The structural model displays the relationships (paths) between constructs in the proposed study model. The  $R^2$  values are 72.1% for authentic experience, and 58.0% for behavioral intention. Given the absence of multivariate normality in the data, path estimates and t-statistics for these relationships were analyzed using the bootstrapping method (Hair et al., 2006). To assess the sampling distribution's shape non-parametrically, the PLS bootstrap method was employed, involving 5000 resamplings. H1 assesses whether Innovation Diffusion (ID) is positively related to Behavioral Intention (INT). The results showed that ID does not have a significant impact on INT ( $\beta=0.207$ ,  $t=1.049$ ,  $p=0.294$ ). Consequently, H1 is rejected. H2 assesses whether Innovation Diffusion (ID) has a significant impact on Authentic Experience (AUT). The results showed that ID has a significant impact on AUT ( $\beta=0.849$ ,  $t=30.349$ ,  $p=0.000$ ). Consequently, H2 is accepted. The results showed that AUT has a significant impact on INT ( $\beta=0.578$ ,  $t=2.850$ ,  $p<0.05$ ). Therefore, H3 was accepted. H4 assesses whether AUT mediates the relationship between ID and INT. The results show that the total effect (H4) was found positive and significant ( $\beta=0.698$ ,  $t=11.985$ ,  $p=0.000$ ). Because ID does not have a significant impact on INT ( $\beta=0.207$ ,  $t=1.049$ ,  $p=0.294$ ), while the indirect effect with the inclusion of the mediator in the analysis was found significant ( $\beta=0.491$ ,  $t=2.726$ ,  $p=0.006$ ), the results reveal a total mediation. This shows that ID indirectly influences via AUT the INT variable. Therefore, H4 is accepted.

### Conclusions

Traditionally, Rogers' Innovation Diffusion Theory has been instrumental in predicting and explaining the adoption rates of new technologies based on attributes like simplicity, compatibility, and perceived benefits. However, the lack of direct influence of these attributes on behavioral intentions in this context suggests that the theory may require adaptation or extension to better suit the VR tourism domain. This stands in contrast to other studies where innovation diffusion attributes significantly influenced behavioral intentions, as seen in VR in tourism adoption contexts. For instance, Kim et al. (2020a) found that these attributes directly affected user adoption decisions. The specific lack of direct influence of innovation attributes on the behavioral intentions of Sicilians might also highlight the role of cultural and contextual factors in technology adoption. Sicilian tourists may value experiential elements (like authenticity and immersive quality) over functional attributes (like ease of use or compatibility), which could differ in other cultural or demographic segments. This aspect underlines the need for more culturally nuanced models in VR tourism research, as suggested by studies like those of Hassan and Rahimi (2016), which emphasize the cultural dimensions of technology adoption. The full mediation by authentic experience suggests that the perceived authenticity of VR experiences plays a significant role in how these technological attributes translate into behavioral intentions. This implies that in the context of VR tourism, especially among Sicilian tourists exploring Romanian ecotourism destinations, the realism provided by VR are more significant in influencing their decision to visit these places than the basic technological attributes themselves. This finding aligns with research by Kim et al. (2020b), which highlighted the importance of authentic experiences in shaping tourist behaviors through VR.

The discovery that innovation diffusion attributes don't directly influence Sicilian tourists' intentions to use VR for visiting Romanian ecotourism destinations, while authentic VR experiences do, suggests managerial actions should focus on enhancing the realism and immersion of VR content. Tourism managers need to prioritize authenticity in VR presentations, using high-quality visuals and interactive elements that accurately reflect the destination. Marketing strategies should emphasize these authentic experiences, potentially integrating VR with promotional offers to transform virtual engagement into actual visits. Additionally, continuous feedback collection and investment in staff training on immersive storytelling and VR technologies are essential for continually refining the VR experience to meet and exceed tourist expectations, ensuring that the VR journey feels as compelling and inviting as the actual destination.

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