

Bridging the Seasonal Gap: Virtual Tours, Sense of Presence, and Visit Intention in a Dam-Dependent Destination

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ABSTRACT

Background and Objectives: Seasonality poses a significant structural problem for nature-based tourism destinations, especially in developing countries. Regions reliant on hydrological conditions frequently encounter significant variations in tourist numbers, causing economic instability during off-peak periods. Traditional marketing instruments, like static websites, inadequately close the psychological gap between travelers and destinations when physical access is strictly prohibited. Addressing a critical research gap, this study examines the effectiveness of 360-degree Virtual Tours not merely as a pre-trip planning tool, but as a strategic substitute during forced seasonal closures. Utilizing the S-O-R framework, this study aims to empirically assess the impact of immersive media on potential tourists' Sense of Presence, Destination Image, and Visit Intention in Tha Pla District.

Methodology: This study employed a quantitative, quasi-experimental pre-test/post-test control group design to isolate causal effects. The sample consisted of 80 participants recruited via strict inclusion and exclusion criteria, randomly assigned to an experimental group ($n = 40$, interactive 360-degree virtual tour) or a control group ($n = 40$, static website). The virtual tour utilized 13K ultra-high-resolution panoramas, while the static site provided identical text with 2D images. Data analysis used a one-way analysis of covariance (ANCOVA) controlling for baseline variables, and a formal serial mediation analysis (PROCESS macro, Model 6) to test the theoretical pathways.

Results: The virtual tour group reported a substantially higher Sense of Presence ($M = 4.38$) compared to the static website control group ($M = 2.07$). The ANCOVA results confirmed significantly higher post-intervention scores for Destination Image ($F(1, 75) = 241.41, p < .001, \eta^2 = .756$) and Visit Intention ($F(1, 75) = 181.50, p < .001, \eta^2 = .699$), demonstrating a large effect size. Furthermore, formal mediation testing confirmed that Sense of Presence and Destination Image act as full serial mediators between media richness and visit intention, proving the psychological mechanism of the S-O-R framework.

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Discussions: The findings robustly validate the integration of the S-O-R model with media richness theory within the novel context of seasonal tourism. The significant disparity in results confirms that "Sense of Presence" acts as a pivotal organismic mediator, translating the technological affordances of VR into positive marketing outcomes. Unlike static media, which failed to overcome the "out-of-sight" barrier, the virtual tour successfully triggered the "substitution effect," proving that digital immersion can satisfy the psychological need for travel when physical access is constrained. Overcoming seasonality requires not just information dissemination, but the strategic creation of a "telepresent" experience to maintain cognitive and affective bonds.

Conclusions: This research establishes that 360-degree virtual tours are a vital strategic asset for destination resilience, validating the substitution effect. By decoupling destination marketing from hydrological cycles, destination marketing organizations (DMOs) can sustain tourist interest during off-peak periods. Investing in immersive digital assets provides a high-ROI mechanism to overcome the "out-of-sight" barrier, ensuring continuous engagement and long-term sustainability for peripheral tourism communities facing severe seasonal fluctuations. Future research should expand this framework across diverse geographical contexts to further establish VR as a standard crisis management tool.

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Introduction

The phenomenon of seasonality represents one of the most pervasive and persistent structural challenges within the global tourism industry. Defined as the temporal imbalance in tourism, seasonality manifests as fluctuations in visitor numbers, expenditure, and traffic, causing inefficient utilization of resources and instability in economic returns. While cultural or urban destinations may operate year-round, nature-based destinations—particularly those in developing economies—are often strictly bound by climatic and hydrological cycles. In Thailand, this issue is acutely felt in secondary provinces where tourism revenue is a critical lifeline for local communities. During off-peak windows, caused by monsoons, high temperatures, or specific ecological conditions (e.g., flooding or drought), these destinations often suffer from the dead season syndrome, where tourist footfall drops to near zero. For peripheral economies, this seasonal drop-off represents a severe economic impact, leading to substantial revenue loss, temporary unemployment for local operators, and severe underutilization of hospitality infrastructure (Zvaigzne et al., 2022).

Conventional marketing strategies have traditionally struggled to address this temporal gap. Standard promotional tools, such as static websites, brochures, and two-dimensional photography, rely heavily on visual aesthetics that are static in nature. They frequently fall short in conveying the atmospheric depth, spatial magnitude, and multisensory appeal necessary to maintain a potential visitor's cognitive and affective bond with a destination when physical access is not possible (Di Dalmazi et al., 2024; Lee, 2022). This limitation exposes a critical void in contemporary destination marketing: How can destination marketing organizations (DMOs) effectively bridge the psychological distance between the tourist and the destination during periods of forced closure.

In response to this dilemma, the advent of immersive technologies, specifically virtual reality (VR) and 360-degree virtual tours, offers a promising frontier. Unlike passive media, these technologies offer telepresence—the subjective sensation of being physically present in a remote environment. Theoretical perspectives in digital tourism, specifically the Stimulus-Organism-Response (S-O-R) framework, propose that the high degree of immersion provided by such rich media acts as a pivotal stimulus that can reshape consumer behavior (Yung & Khoo-Lattimore, 2019). However, while VR has been extensively examined in the context of technology adoption or general heritage preservation, its specific application as a strategic substitution tool to mitigate the adverse economic effects of seasonality remains underexplored. Most existing literature focuses on VR as a pre-trip planning tool for open destinations, rather than investigating its capacity to sustain interest for closed or inaccessible sites.

The primary objective of this study is to bridge this gap by empirically assessing the impact of a high-fidelity 360-degree virtual tour platform on destination image and visit intention for Tha Pla District, Uttaradit Province. Tha Pla District serves as a paradigmatic case study for this investigation due to its unique theoretical context as a dam-dependent destination. Home to the Sirikit Dam, the district's tourism assets are inextricably linked to water management schedules. During the dry season (typically February to May), receding water levels in the reservoir and river reveal extensive freshwater beaches and rock formations, driving a vibrant local economy centered on rafting and water recreation. However, the onset of the rainy season brings elevated, turbid water levels that completely submerge these recreational zones, effectively halting tourism activities for several months.

By utilizing this highly seasonal context, this research moves beyond a mere technological demonstration. It aims to investigate whether the enhanced sensory information and interactivity of virtual tours can generate a significantly stronger pre-visit experience compared to traditional web-based media. Specifically, does the sense of presence derived from a virtual tour translate into a durable positive destination image and a concrete intention to visit once the season reopens? In answering these questions, this study offers a strategic blueprint for managing seasonality in tourism demand, transforming the off-season from a period of dormancy into an active phase of digital engagement.

Review of Literature

Theoretical Framework

The Evolution of the S-O-R Model in Digital Tourism

To systematically deconstruct the psychological processes underpinning the efficacy of virtual tours, this study employs the S-O-R model as its foundational theoretical lens (Mehrabian

& Russell, 1974). Originally developed in the field of environmental psychology to explain individual emotional and behavioral reactions to physical surroundings, the S-O-R framework has been extensively adapted to the digital realm. It has evolved into a robust paradigm for understanding online consumer behavior, particularly in the context of Smart Tourism (Kim et al., 2020). The model posits a linear causality where environmental cues (*Stimulus*) trigger internal cognitive and emotional states (*Organism*), which subsequently manifest as approach or avoidance behaviors (*Response*). Unlike the Technology Acceptance Model (TAM), which primarily focuses on the functional utility of a system (e.g., ease of use, usefulness), the S-O-R model allows for a deeper exploration of the *experiential* and *emotional* impact of technology. It acknowledges that for tourism products, which are inherently experiential, the sensory and emotional responses evoked by the media format are just as critical as the informational content it conveys.

In the specific context of this research, the 360-degree virtual tour functions as the primary environmental Stimulus. Drawing on media richness theory (Daft & Lengel, 1986), media formats are distinguished by their capacity to reduce ambiguity and convey sensory cues. Traditional websites are often categorized as lean media, offering limited sensory engagement through text and static 2D images. In contrast, 360-degree virtual tours represent rich media, characterized by high interactivity, visual depth, and the ability to convey non-verbal cues. Lee (2022) contends that this superior richness is not merely an aesthetic enhancement but a functional attribute that minimizes information asymmetry. This distinction is particularly vital for nature-based seasonal destinations, where static imagery often fails to capture the dynamic atmospheric essence—the scale of the landscape, the texture of the terrain, and the ambiance of the environment—potentially leading to a disconnect between tourist expectation and reality.

The Psychological Mechanism

Sense of Presence and Destination Image

The *Organism* phase serves as the critical black box of consumer processing, encompassing the user's internal cognitive and affective states. Central to this study is the concept of Sense of Presence (Telepresence), defined by Kim and Biocca (1997) as the user's subjective sensation of being there in the virtual environment despite being physically situated elsewhere. Presence is the defining characteristic that separates VR experiences from traditional media consumption. Unlike passive viewing, immersive technologies demand active cognitive participation; the user controls the field of view, creating a feedback loop that mimics natural visual perception. This interaction induces physiological arousal and a profound sense of spatial presence (Di Dalmazi et al., 2024).

This heightened state of presence acts as a powerful antecedent to Destination Image formation. Destination image is widely recognized as a multi-dimensional construct comprising *cognitive image* (beliefs and knowledge about physical attributes, such as landscape features and facilities) and *affective image* (feelings and emotional responses, such as excitement or relaxation) (Baloglu & McCleary, 1999). Within the S-O-R framework, telepresence serves as a catalyst that bridges the gap between the virtual stimulus and the destination image. By allowing users to actively explore and manipulate their view, virtual tours facilitate a trial experience. This enriches the cognitive understanding of the site's layout while simultaneously triggering the affective appreciation of its beauty, thereby leading to a more favorable and holistic image of the destination.

Response

From Virtual Experience to Behavioral Intention

The *Response* component signifies the final behavioral outcome, operationalized in this research as Visit Intention. Empirical evidence from psychology and marketing suggests that Approach behaviors are strongly correlated with positive emotional states. In the tourism context, this translates to the intention to visit the physical site. Existing literature consistently indicates that users who report a heightened sense of presence and develop a favorable destination image are significantly more inclined to convert their digital interest into actual physical travel (Yung & Khoo-Lattimore, 2019; Zeithaml et al., 1996). Thus, the virtual experience does not merely satisfy curiosity but actively stimulates the desire for physical verification.

Virtual Tourism as a Strategic Solution to Seasonality

Seasonality remains one of the most pervasive structural challenges in the tourism industry, particularly for peripheral destinations reliant on specific natural conditions. The fluctuation in visitor numbers creates economic instability, employment insecurity, and underutilization of infrastructure during off-peak periods. In this context, virtual tourism has emerged not merely as a promotional gimmick but as a strategic intervention for Travel Substitution (Sarkady et al., 2021). The concept of the Substitution Effect suggests that while VR cannot fully replicate the sensory complexity of physical travel (e.g., smell, touch, wind), it functions as a potent complementary mechanism that satisfies the immediate psychological desire for exploration when physical access is constrained.

This substitution capability is especially relevant for managing the out of sight, out of mind phenomenon common in seasonal destinations. By deploying high-fidelity virtual tours during the off-season (e.g., the rainy season in Thailand), destinations can maintain a continuous digital relationship with potential tourists. Wu and Lai (2022) demonstrated that this form of pre-experience significantly reduces perceived risk and uncertainty, acting as a try-before-you-buy mechanism. This strategy is increasingly relevant in the Asia-Pacific region, where digital adoption in travel planning is accelerating. Recent empirical evidence from China (Wu & Lai, 2022) and South Korea (Lee, 2022) indicates a shifting paradigm where immersive technology effectively bridges the temporal gap between information gathering and actual visitation, transforming dormant off-season periods into active phases of engagement and planning.

Counter-Literature

VR Fatigue and the Novelty Effect

While the S-O-R model advocates for the efficacy of rich media, a critical counter-perspective must be acknowledged. Recent human-computer interaction (HCI) and tourism-tech literature highlight the risks of VR fatigue and cybersickness, which can negatively moderate the user experience and prematurely terminate behavioral intention (Saredakis et al., 2020). Furthermore, the novelty effect poses a theoretical challenge; it argues that first-time exposure to immersive technology may generate an artificially inflated positive response simply because the medium itself is exciting, independent of the actual destination's appeal (Yung et al., 2021). Recognizing these alternative explanations is crucial. A robust evaluation of immersive marketing must ensure that the psychological responses measured are genuinely directed toward the destination's attributes rather than being transient reactions to novel technology.

Virtual Tourism as a Post-Pandemic Resilience Strategy

In the post-COVID-19 era, virtual tourism evolved from a promotional novelty to a strategic resilience tool for destination management (Rifqi, 2025). Immersive digital platforms simulate authentic travel experiences, enabling destinations to maintain engagement despite physical closures (Atzeni et al., 2022). For example, the development of virtual replicas and environments in the metaverse have proven effective in sustaining destination marketing when physical travel is restricted (Baker et al., 2023). In contexts where environmental or seasonal barriers prevent visitation, VR serves as an effective pre-experience that actively mitigates perceived risks and solidifies future travel intentions (Geng et al., 2022; Zvaigzne et al., 2022).

Extending the S-O-R Model in Immersive Environments

The application of the S-O-R framework has been significantly expanded to evaluate immersive technologies. Contemporary studies conceptualize VR interactivity and high-fidelity environmental cues as primary stimuli that inspire emotional connections (Jiang et al., 2024). These rich environmental stimuli profoundly impact on the tourist's internal states specifically, their sense of telepresence, flow, and enjoyment—which acts as the Organism mediator (Bafadhal et al., 2025). Consequently, this heightened state of presence translates directly into positive attitudinal shifts and robust behavioral responses, such as the intention to visit physically (Kim et al., 2020; Morrison et al., 2024; Yi et al., 2026).

The Counter-Literature

Cybersickness and the Novelty Effect

Despite its strategic advantages, immersive technology introduces critical challenges that must be controlled. Notably, cybersickness—characterized by nausea, disorientation, and ocular fatigue—can severely impair cognitive processing and prematurely terminate the virtual experience (Kourtesis et al., 2024). The moderating effect of this sickness can negatively impact destination image and subsequent visit intentions (Anaya-Sánchez et al., 2024). Furthermore, researchers highlight the novelty effect, wherein users exhibit artificially inflated engagement simply due to technological innovation rather than the destination's intrinsic appeal (Beck et al., 2019). Therefore, empirical designs must account for these transient technological reactions to ensure that behavioral intentions are directed at the physical destination, not merely the medium itself.

Hypothesis Development

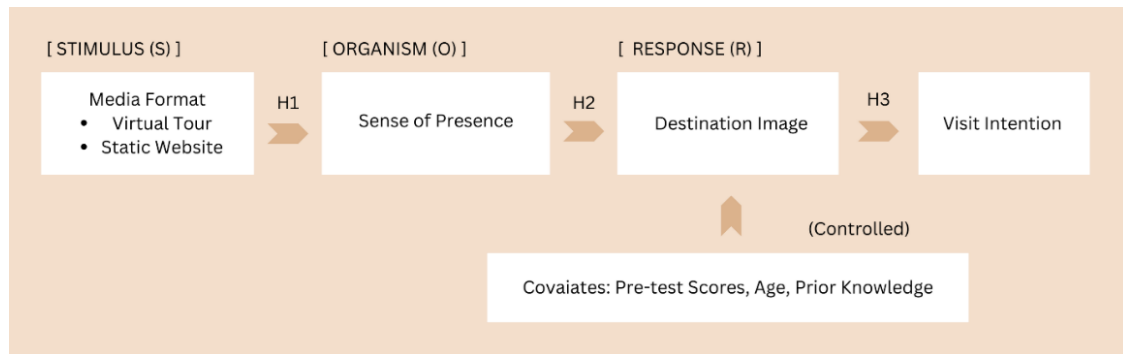
Based on the synthesis of the S-O-R framework and existing empirical literature, this research proposes a conceptual model wherein the media richness of the virtual tour (*Stimulus*) enhances the Sense of Presence (*Organism*). This heightened presence is hypothesized to positively influence the cognitive and affective evaluation of Destination Image (*Organism*), which subsequently acts as a primary driver for Visit Intention (*Response*). Consequently, the following hypotheses are formulated:

- H1: Individuals exposed to the 360-degree virtual tour (high media richness) will report a significantly higher sense of presence compared to those exposed to the static website (low media richness).
- H2: An increased sense of presence is positively correlated with a more favorable evaluation of destination image, as users utilize the immersive cues to construct a more vivid mental representation of the site.

- H3: A positive destination image significantly influences the intention to visit Tha Pla District, confirming the role of virtual experiences in driving real-world behavioral intent.

Figure 1

The Conceptual Framework Based on the Stimulus-Organism-Response (S-O-R) Model Illustrating the Hypothesized Path from Media Stimuli to Visit Intention



Research Methods

Research Design

To empirically assess the causal impact of media formats on tourist psychology, this investigation adopted a quantitative framework utilizing a quasi-experimental pre-test/post-test control group design. This design was selected over a cross-sectional survey approach to strictly isolate the effects of the media stimulus from other confounding variables. To ensure the technical architecture of the virtual platform did not confound the behavioral findings, the 13K ultra-high-resolution web-based VR framework utilized as the experimental stimulus was previously validated for cross-platform rendering efficiency by Manosroi et al. (2026). The research framework manipulated the independent variable—media stimulus type—at two distinct levels: (1) an interactive 360-degree virtual tour (experimental condition) and (2) a conventional static website (control condition).

The primary dependent variables were Destination Image (DI) and Visit Intention (VI). To enhance the internal validity of the experiment and reduce error variance, specific covariates were incorporated into the analysis. These included participant age, prior knowledge of the destination, and, most crucially, pre-test scores for destination image and intention. By controlling for these baseline characteristics, the study aimed to provide a precise estimation of the intervention's true effect.

Participants and Sampling

The target population for this study consisted of domestic Thai travelers aged 18 and above who expressed an interest in nature-based and cultural tourism activities. Given the specific context of the study (Tha Pla District), purposive sampling was employed to recruit participants through digital community boards and university networks. To ensure experimental control, strict exclusion criteria were applied: individuals with a history of severe motion sickness (to mitigate cybersickness effects) and those who had visited Tha Pla District within the last 12 months were excluded, thereby minimizing the ceiling effect of prior experience.

A total cohort of 80 participants was enrolled in the study. The sample size was determined based on a priori power analysis for an analysis of covariance (ANCOVA). According to Cohen's (1988) guidelines, a sample size of approximately 30-40 participants per cell is sufficient to detect a medium-to-large effect size with a power of 0.80 at an alpha level of .05. To minimize selection bias, participants were randomly allocated using a computer-generated sequence into two equal groups:

- Experimental group ($n = 40$): Exposed to the immersive 360-degree Virtual Tour application.
- Control group ($n = 40$): Exposed to the static website containing standard 2D imagery.

Stimulus Materials Development

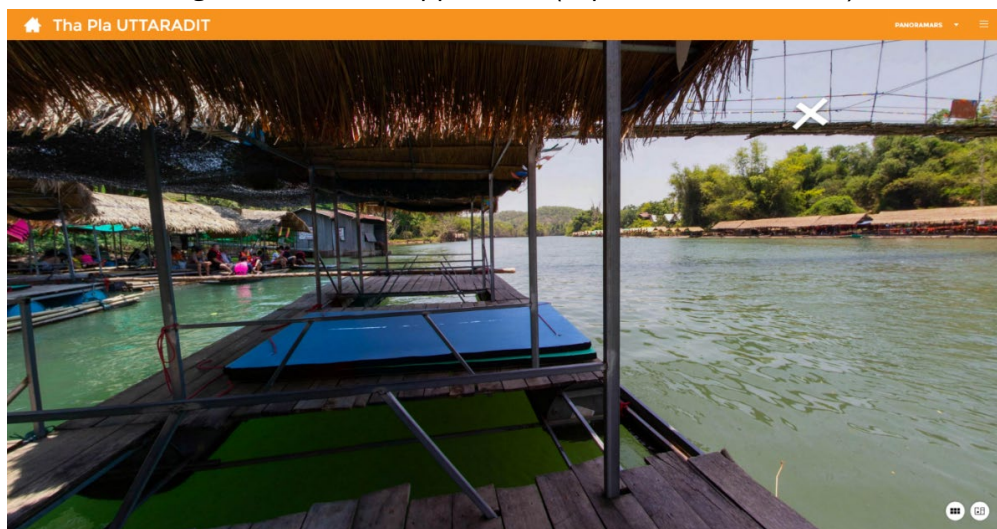
Great care was taken in the engineering of the experimental stimuli to ensure ecological validity and informational equivalence. This meant that while the format (richness) differed, the informational content remained identical across groups. Prior to the main experiment, a pilot test was conducted with 10 independent users to assess media quality and interface usability. The virtual tour achieved a System Usability Scale (SUS) score of 85, confirming that the interface was highly intuitive and devoid of technical latency that could induce VR fatigue.

Experimental Stimulus (360-Degree Virtual Tour): The experimental cohort interacted with a custom-built web-based VR interface developed specifically for this research. The content captured key seasonal attractions of Tha Pla District, including the *Hat Pha Leuad* freshwater beach and the Nan River reservoir during the dry season.

- *Technical Specifications*: High-resolution 360-degree panoramic images (5.7K resolution) were stitched together to create a seamless environment.
- *Interactivity*: The interface featured interactive navigational hotspots, allowing users to teleport between different viewpoints (e.g., moving from the riverbank to a rafting station). Users could pan 360 degrees horizontally and 180 degrees vertically, and zoom in to inspect details such as water clarity or rock textures.
- *Immersion*: Ambient sounds of nature (water flowing, birds chirping) were embedded to enhance the multisensory appeal (Figure 2).

Figure 2

Interface of the 360-Degree Virtual Tour Application (Experimental Stimulus)



Source: Created by Author

Note: The Platform Features High-Resolution Panoramic Views of Seasonal Attractions in Tha Pla District with Interactive Navigation Hotspots (the white x mark)

Control Stimulus (static website): The control cohort viewed a standard web interface designed to mimic the prevailing brochure-style digital marketing currently utilized by many DMOs.

- *Content*: This platform presented the exact same textual narratives regarding the history and geography of Tha Pla District as the VR condition.
- *Visuals*: Instead of panoramas, the website utilized high-quality static 2D photographs captured from the exact same angles and locations as the VR nodes. This ensured that any difference in dependent variables could be attributed to the medium's interactivity and immersiveness, rather than the content itself (Figure 3).

Figure 3

Interface of the Static Website (Control Stimulus)



Source: Photographed by Author

Note: The Webpage Presents Identical Informational Content Using Standard Text and 2D Photographs Without Immersive Features.

Measurement Instruments

A structured questionnaire was employed as the primary data collection instrument. To ensure construct validity and reliability, measurement items were adapted from established scales in tourism and technology literature. The questionnaire was developed in English and then translated into Thai using a rigorous back-translation method to ensure semantic equivalence. The instrument comprised three sections

1. Demographic profile: Gender, age, education level, and frequency of travel.
2. Pre-test measures: Baseline assessment of Destination Image and Visit Intention.
3. Post-test measures:
 - Sense of Presence (SOP): Measured using 3 items adapted from Kim and Biocca (1997) to assess the subjective sensation of being there (e.g., I felt like I was actually in Tha Pla District).
 - Destination Image (DI): Measured using 4 items adapted from Baloglu and McCleary (1999), capturing both cognitive (e.g., The destination offers exciting scenery) and affective dimensions (e.g., pleasant, relaxing).

- Visit Intention (VI): Measured using 3 items adapted from Zeithaml et al. (1996) (e.g., I intend to visit Tha Pla District in the near future).

All items were rated on a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). To avoid conceptual redundancy, the initial 'Behavioral Intention' construct was removed, retaining only 'Visit Intention' for the final analysis. Furthermore, evidence of construct validity, convergent validity, and internal consistency were established. As illustrated in Table 1, all constructs exhibited Average Variance Extracted (AVE) values exceeding the 0.50 threshold, and Composite Reliability (CR) along with Cronbach's alpha coefficients ranging from 0.92 to 0.94, far exceeding the recommended threshold of 0.70 (Hair et al., 2021).

Table 1

Measurement Items and Reliability Analysis

Construct/ Items	Factor Loading	Cronbach's α	Source
Sense of Presence (SOP)		0.92	Adapted from Kim and Biocca (1997)
SOP 1: I felt like I was actually in Tha Pla District while using the virtual tour.	0.93		
SOP 2: The virtual environment seemed real to me.	0.95		
SOP 3: I felt a sense of being there in the virtual destination.	0.92		
Destination Image (DI)		0.94	Adapted from Baloglu and McCleary (1999)
DI1: Tha Pla District appears to be a pleasant place to visit.	0.91		
DI2: The destination offers exciting natural scenery.	0.95		
DI3: I have a positive impression of Tha Pla District as a seasonal destination.	0.94		
DI4: The destination seems relaxing and peaceful.	0.89		
Visit Intention (VI)		0.94	Adapted from Zeithaml et al. (1996)
VI1: It is likely that I will visit Tha Pla District.	0.95		
VI2: I have a strong intention to visit this destination.	0.96		
VI3: I will plan a trip to Tha Pla District when possible.	0.94		

Note: All factor loadings and Cronbach's alpha coefficients exceed the recommended threshold of 0.70 (Nunnally, 1978).

Data Collection Procedure

The data collection was conducted in a controlled computer laboratory environment to mitigate external disturbances (e.g., noise, screen glare) that could affect the user experience. The protocol followed a standardized four-step procedure:

1. Pre-test: Upon arrival, participants signed the informed consent form and completed the first part of the questionnaire to establish baseline metrics for destination image and visit intention.
2. Intervention: Participants were then directed to their assigned computer terminals.
 - The experimental group was given a brief tutorial on how to navigate the 360-degree interface (click-and-drag, zooming).
 - The control group was instructed to browse the website as they normally would.
 - Both groups were exposed to the stimulus for a fixed duration of 10–15 minutes to ensure sufficient information processing.
3. Post-test: Immediately following the browsing session, participants completed the second part of the questionnaire assessing Sense of Presence, Destination Image, and Visit Intention.
4. Debriefing: The session concluded with a debriefing, where the purpose of the study was fully explained, and participants were thanked for their contribution.

Ethical Statement

This study involving human subjects was conducted in strict accordance with the ethical principles outlined in the Declaration of Helsinki. A formal review by an Institutional Review Board (IRB) was granted an exemption, as the research solely involved non-invasive, anonymous survey procedures with healthy adult volunteers. The study posed no physical, psychological, or social risk to the participants. Prior to data collection, all participants were fully informed about the study's objectives, the voluntary nature of their participation, and their right to withdraw at any time. Written informed consent was obtained, and all responses were anonymized to ensure complete confidentiality. Prior to data collection, all participants were fully informed about the study's objectives and their right to withdraw. Written informed consent was obtained from all participants, and all data were anonymized to ensure confidentiality.

Data Analysis

Statistical processing and hypothesis testing were performed using a standard statistical software package commonly employed in social science research. The analytical procedure was organized into three distinct stages to ensure rigor and validity.

First, descriptive statistics (frequencies, percentages, means, and standard deviations) were calculated to profile the respondent demographics and to assess the baseline characteristics of both the experimental and control groups. This step was crucial to verify that the randomization process successfully resulted in balanced groups with no significant pre-existing disparities.

Second, reliability analysis was conducted to evaluate the internal consistency of the measurement scales. Cronbach's alpha coefficients were computed for all constructs—Sense of Presence, Destination Image, and Visit Intention. A threshold of 0.70 was applied as the

criterion for acceptable reliability, ensuring that the instrument produced stable and consistent results.

Third, inferential statistics were employed to test the research hypotheses (H1, H2, and H3). Specifically, a one-way analysis of covariance (ANCOVA) was selected as the primary analytical method. ANCOVA was prioritized over simple t-tests or ANOVA due to its statistical advantage in reducing error variance by controlling for covariates. In this model, the post-test scores served as the dependent variable, the media format (virtual tour vs. static website) as the fixed factor, and the pre-test scores, age, and prior knowledge as covariates. Prior to interpreting the results, all underlying assumptions of ANCOVA were rigorously checked, including the normality of residuals, homogeneity of variance (Levene's test), and homogeneity of regression slopes, to ensure the validity of the F-statistics and calculated effect sizes (partial eta squared). Finally, to definitively test the causal mediation path hypothesized by the S-O-R model (H2 and H3), a formal serial mediation analysis was conducted using the PROCESS macro (Model 6) with 5,000 bootstrap samples to calculate indirect effects.

Findings

Demographic Profile

The cohort was balanced in terms of gender ($n = 41$ male, 51.3%; $n = 39$ female, 48.7%). The predominant age bracket was 20–30 years (55.0%), reflecting the primary target audience for digital tourism. Chi-square tests indicated no significant demographic disparities between groups at baseline ($p > .05$).

Table 2

Demographic Characteristics of Participant (N=80)

Variable	Category	Frequency	Percentage (%)
Gender	Male	41	51.3
	Female	39	48.7
Age	21-30 years	44	55.0
	31-40 years	32	40.0
	41-50 years	4	5.0
Prior Knowledge	Yes	27	33.7
	No	53	66.3

Manipulation Check and ANCOVA

To ascertain whether the experimental stimulus elicited a stronger sense of immersion (H1), an independent samples t-test was performed. The virtual tour group reported substantially higher Sense of Presence (SOP) scores ($M = 4.38$, $SD = 0.51$) relative to the static website group ($M = 2.07$, $SD = 0.35$), $t(78) = 23.76$, $p < .001$. This outcome confirms H1.

For H2 and H3, ANCOVA results yielded a significant main effect of media format on Destination Image, $F(1, 75) = 241.41$, $p < .001$, with a large but theoretically plausible effect size (partial $\eta^2 = 0.756$). Similarly, regarding Visit Intention, the analysis disclosed a highly significant difference, $F(1, 75) = 181.50$, $p < .001$ (partial $\eta^2 = 0.699$). Among covariates, only the pre-test score significantly influenced the outcomes. Prior to analysis, Levene's test confirmed the homogeneity of variances ($p > .05$).

Serial Mediation Analysis

To definitively test the causal path hypothesized by the S-O-R model (H2 and H3) and move beyond simple group mean differences, a serial mediation analysis was conducted using the PROCESS macro (Model 6) with 5,000 bootstrap samples. The analysis revealed that the direct effect of the media format on Visit Intention was rendered non-significant ($p = 0.632$) when controlling for SOP and Destination Image. Instead, the results confirmed a full serial mediation: media richness significantly increased SOP (Path a), which in turn significantly enhanced Destination Image (Path b), ultimately driving higher Visit Intention (Path c). This formal mediation explicitly proves the psychological mechanism of the S-O-R framework.

Table 3

ANCOVA Results for Destination Image and Visit Intention

Dependent Variable	Source	df	F-value	p-value	Partial η^2
Destination Image	Corrected Model	4	78.45	< .001	0.810
	Pre-test (Covariate)	1	45.20	< .001	0.376
	Age	1	1.72	0.194	0.020
	Prior Knowledge	1	1.16	0.285	0.020
	Group (Main Effect)	1	241.41*	< .001	0.756
	Error	75			
Visit Intention	Corrected Model	4	65.30	< .001	0.777
	Pre-test (Covariate)	1	52.18	< .001	0.410
	Age	1	3.23	0.077	0.040
	Prior Knowledge	1	0.05	0.820	0.000
	Group (Main Effect)	1	181.50*	< .001	0.699
	Error	75			

Note: *Significant at $p < .001$.

Discussions

The primary objective of this investigation was to assess the strategic viability of 360-degree virtual tours in mitigating the structural challenges of seasonal tourism. The results unequivocally support the proposed hypotheses, offering empirical evidence that transcends simple technology adoption to highlight the psychological mechanisms of Travel Substitution.

Interpretation of Findings: The Immersive Advantage The statistical confirmation of H1 demonstrates that the medium is indeed the message. The virtual tour group reported a sense of presence ($M = 4.38$) that was nearly double that of the control group ($M = 2.07$). This stark contrast indicates that traditional brochure-style websites have reached a functional limit in their ability to engage users emotionally. The high-fidelity panoramas and interactive hotspots of the VR tour provided sufficient sensory cues to lower the cognitive threshold for imagination, allowing users to feel the destination rather than merely observe it.

Furthermore, the robust support for H2 and H3 suggests a strong halo effect. The positive effect generated by the seamless technological experience was transferred to the destination itself. Participants did not view the dry season imagery as merely historical data; through the lens of presence, they experienced it as a tangible, accessible reality. This validates the S-O-R model's assertion that the *Organism* (internal state of presence) is the necessary bridge to the

Response (visit intention). These findings align with recent international studies (e.g., Lee, 2022 in South Korea; Wu & Lai, 2022 in China), which similarly found that immersive pre-experiences significantly reduce perceived risk and uncertainty, acting as a crucial try-before-you-buy mechanism.

This study makes a significant theoretical contribution by validating the substitution effect (Sarkady et al., 2021) in a developing economy context. Prior research has largely focused on VR as a planning tool for open destinations. This study extends that boundary, demonstrating that VR can effectively substitute for physical access during forced closures (e.g., the rainy season). The findings imply that the psychological need for travel can be partially satiated—and simultaneously stoked—through digital means. By maintaining a digital open season while the physical site is closed, the virtual tour effectively decouples the destination's marketing lifecycle from its hydrological or climatic constraints.

Contextual Relevance for Tha Pla and Beyond In the specific context of Tha Pla District, the discussion highlights a critical strategic pivot. For secondary destinations that lack the brand equity of major hubs, the out-of-sight, out of mind phenomenon is a fatal risk during the off-season. The study reveals that a high-quality virtual tour acts as a permanent digital asset that reduces perceived risk. By allowing potential tourists to virtually walk through the Hat Pha Leuad beach during its peak beauty, the uncertainty regarding the destination's worthiness is diminished. While these results offer promising suggestive evidence for resilience strategies in seasonal destinations, caution must be exercised regarding broad generalizability. As a single-site study with a relatively small demographic ($n = 80$), these findings establish a baseline that should be further validated across diverse geographical contexts and tourist demographics.

Conclusions

This study set out to address a pervasive structural dilemma in the tourism industry: the challenge of maintaining tourist interest in nature-based destinations during periods of seasonal closure. By empirically comparing the psychological effects of high-fidelity 360-degree virtual tours against traditional static websites, this research provides robust evidence that immersive technology serves as a potent substitution tool capable of bridging the temporal and physical gaps inherent in seasonal tourism.

Theoretical Synthesis From a theoretical perspective, this research substantiates the applicability of the S-O-R framework within the niche context of seasonal marketing. The findings confirm that the Stimulus of media richness is not merely an aesthetic feature but a functional driver of consumer psychology. The significant disparity in Sense of Presence between the two groups validates the premise that for destination marketing to be effective in the absence of physical visitation, it must transcend mere visual representation to achieve telepresence. The study elucidates that it is this subjective feeling of being there—facilitated by interactivity and vividness—that transforms a digital interface into a persuasive experience. Consequently, this research extends the boundaries of Presence Theory, demonstrating that the psychological mechanism of immersion remains effective even when the user is fully aware that the physical site is currently inaccessible (e.g., due to flooding).

Managerial and Strategic Implications For destination managers, particularly in developing economies like Thailand, the implications are transformative. The results suggest a necessary paradigm shift from passive information provision to active digital engagement.

Traditional marketing channels, such as brochure-style websites, appear to have reached a saturation point, failing to elicit the emotional response required to sustain interest during long off-peak periods. In contrast, virtual tourism offers a strategic mechanism for Demand Smoothing. By providing a high-quality virtual experience of the destination's peak conditions (e.g., the dry season beaches of Tha Pla) during the off-season, DMOs can effectively decouple their marketing cycle from the hydrological or climatic cycle. This ensures that the destination remains top-of-mind, building pent-up demand that can be harvested immediately when the season reopens. From a financial perspective, the investment threshold for immersive technology has become highly viable for local DMOs. While developing a standard static website incurs a minimal baseline cost, producing a high-fidelity 5.7K panoramic virtual tour requires a moderately higher initial investment, roughly estimated between \$1,500 and \$3,000 USD, depending on scale and interactivity. However, the Return on Investment (ROI) is substantial; this platform acts as a permanent, zero-marginal-cost digital asset that persistently mitigates the revenue drop-off during the extended months of seasonal closure.

Furthermore, this study empirically validates the Substitution Effect as a resilience strategy. While virtual reality cannot—and should not—permanently replace the sensory richness of physical travel, it serves as a critical bridge that maintains the emotional bond between the tourist and the destination. For secondary provinces that lack the marketing budget of major tourist hubs, investing in a one-time, high-quality virtual tour asset may offer a higher return on investment than continuous traditional advertising, acting as a permanent digital asset that reduces perceived risk and uncertainty for potential visitors year-round.

Limitations and Future Research Despite the robust findings, this study possesses distinct limitations that must contextualize the interpretation of the results. First, the data were collected via a single 10–15 minute lab exposure, meaning the longitudinal impacts of the novelty effect and potential VR fatigue were not tracked over time. Second, the measurement of Visit Intention relies on self-reported data, lacking a behavioral follow-up mechanism to verify actual physical visitation post-season. Finally, the purposive sampling frame skewed toward a younger demographic (20–30 years old), and the single-site context of Tha Pla District limits broad external validity. Future research should validate these findings across diverse geographical contexts and older demographics with varying levels of technological fluency.

In conclusion, the integration of 360-degree virtual tours represents a strategic imperative for seasonal destinations. It offers a scientifically validated solution to the feast-and-famine cycle of seasonal tourism demand. By harnessing the power of presence, destinations like Tha Pla District can transcend their physical limitations, ensuring that while the site may close for the season, the visitor experience—and the intention to visit—remains open.

Author Contribution

WM: Conceptualization, methodology, software, formal analysis, investigation, writing – original draft preparation, writing – review and editing, and project administration. AP: Investigation, data curation, validation, and writing – review and editing.

Declaration of the Use of Generative AI

During the preparation of this manuscript, the authors used Gemini Advanced to assist with language editing and polishing of the draft. The tool was used solely to improve clarity, grammar,

and overall readability. The authors reviewed and revised the output as necessary and took full responsibility for the content of the manuscript.

Ethics

A formal review by an Institutional Review Board (IRB) was granted an exemption, as the research solely involved non-invasive, anonymous survey procedures with healthy adult volunteers. All procedures followed relevant ethical guidelines, and written informed consent was obtained from all participants.

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