



## Research Article

# BIBLIOMETRIC INSIGHTS AND AN INTEGRATED MODEL OF SERVICESCAPES IN VIETNAM'S SMART AMUSEMENT PARKS

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## ABSTRACT

*In immersive, technology-driven service environments, gaining insight into how physical, social, and intelligent design elements collectively shape customer behavior is crucial for tourism research. Focusing on smart amusement parks in Vietnam—digital leisure spaces that integrate spatial design, social interaction, and intelligent systems—this study examines how these multidimensional servicescape factors interact to influence customer perception, satisfaction, and loyalty. A bibliometric analysis identified key themes and gaps in servicescape literature. Using the stimulus–organism–response (S–O–R) framework, a conceptual model was tested using partial least squares structural equation modeling (PLS-SEM) with 399 valid survey responses. Findings reveal that physical, social, and intelligent servicescapes significantly shape customer perception, which mediates the relationships with satisfaction and loyalty. Additionally, the intelligent servicescape indirectly influences behavior through social pathways. This study advances research into digital service environments. For practitioners, it underscores the need to balance aesthetics, social dynamics, and technology to create engaging, loyalty-enhancing experiences.*

**Keywords:** intelligent servicescape; smart amusement parks; S–O–R

## 1. Introduction and Literature Review

### 1.1. Introduction

The evolution of smart technologies has transformed service environments into highly interactive, data-driven ecosystems, particularly in the tourism and leisure sectors. Smart amusement parks now combine the physical environment, human interaction, and intelligent systems to create immersive customer experiences. However, the question of how this triad jointly influences customer perception and behavior remains largely unstudied and, as a result, poorly understood. Servicescape theory (Bitner, 1992) provides a foundation; however, previous studies have often treated components in isolation and offered only fragmented portrayals of the service environment. This study addresses this fragmented understanding by proposing and testing an integrated servicescape model grounded in Bitner's theory in Vietnam's smart amusement parks.

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## 1.2. Bibliometric analysis and research gaps

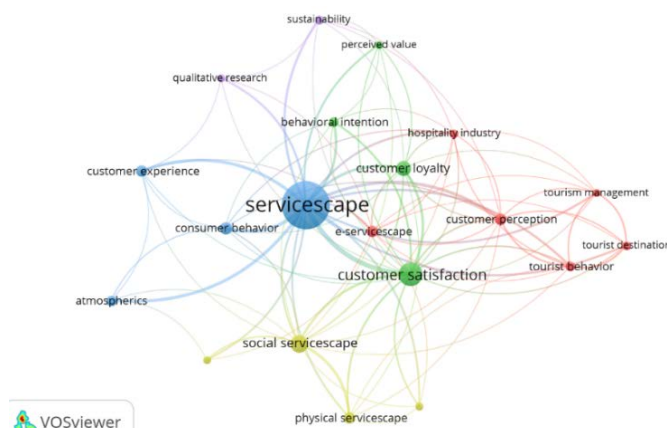


**Figure 1.** Keyword co-occurrence map

The bibliometric analysis was conducted to examine the current state of servicescape research. It involved 423 Scopus-indexed articles. Keyword co-occurrence mapping was performed in VOSviewer (Van Eck & Waltman, 2010). A manually curated thesaurus and the full counting method were used. Keywords occurring at least eight times were included to support thematic clarity. The analysis identified well-developed clusters relating to physical and social servicescapes (yellow cluster), typically linked to customer behavior in settings such as hotels and restaurants (Al Halbusi et al., 2020; Bitner, 1992; Gulzar, 2023). In contrast, e-servicescape formed a separate red cluster associated with tourist behavior and customer perception (Zupic & Čater, 2015). This reflects a fragmented focus on digital platforms such as websites and mobile apps (Hopkins et al., 2009).

Recent research highlights how intelligent technologies—such as personalized recommendations and adaptive digital systems—are reshaping physical spaces to offer more responsive, customized customer experiences (Valente-Pedro et al., 2023; Yin et al., 2023). These environments, often enhanced with smart signage and interactive displays, are better described as intelligent servicescapes. Despite this shift, few studies have examined how physical, social, and intelligent elements operate together within a single model, and even fewer have explored how customer perception mediates their effects (Durna et al., 2015; Wu et al., 2018). This gap is especially clear in smart amusement parks, where space, people, and technology merge in real time to create immersive experiences (Bonfanti et al., 2023; Wu et al., 2018). To address this gap, the current study introduces an integrated framework that explains how these combined elements shape customer perception, satisfaction, and loyalty in technology-driven tourism settings.

Servicescape refers to the physical, social, and technological environments that shape customers' experiences in a service context (Bitner, 1992). The physical servicescape comprises the ambient conditions, spatial layout, and appearance that elicit cognitive and emotional responses from customers (Morkunas et al., 2024; Wakefield & Blodgett, 1996).

However, even a well-designed physical environment may be ineffective if it does not support social interaction (i.e., if customers are not engaging with employees). Well-designed surroundings can also foster social interactions; that is, when physical spaces encourage socializing and behavioral flow, their design supports the servicescape (Gulzar, 2023; Lyu et al., 2017). Thus, we hypothesize (H1): Physical servicescape positively influences social servicescape.

A service environment can be considered intelligent when it integrates smart technologies such as artificial intelligence, digital signage, and automated systems that offer adaptive, frictionless interactions (Roy et al., 2019; Yin et al., 2023). These interactions can, in turn, support social connectedness in contemporary service encounters. H2: Intelligent servicescape positively influences social servicescape.

Environmental factors such as lighting, scent, and spatial arrangement directly shape perception by influencing customers' judgments and feelings (Abdel-Aal & Abbas, 2016; Bitner, 1992). H3: Physical servicescape positively influences customer perception.

The social servicescape, in which interactions occur among customers and employees, plays an important role in shaping the emotional tone and perceived quality of a service (Ali et al., 2024; Tombs & McColl-Kennedy, 2003). These interactions provide the social context in which customers evaluate service experiences. **H4: Social servicescape positively influences customer perception.**

Technologies that provide personalization and control (e.g., mobile apps, virtual assistants) reinforce a sense of modernity and control, shaping favorable perceptions (Roy et al., 2019; Yin et al., 2023). H5: Intelligent servicescape positively influences customer perception.

The internal response of perception links external stimuli with customer outcomes. Positive customer perceptions are associated with satisfaction (Kandampully et al., 2023). Furthermore, favorable customer perceptions may strengthen loyalty even in the absence of satisfaction (Anderson & Sullivan, 1993; Wu et al., 2018). In this way, perception connects a positive external stimulus to internal customer outcomes (satisfaction and loyalty). Two hypotheses follow from this argument: **H6: Customer perception positively influences customer satisfaction; H7: Customer perception positively influences customer loyalty.**

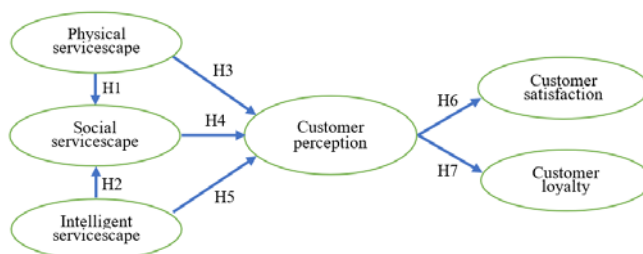


**Figure 2.** Proposed model

This study is grounded in the stimulus–organism–response (S–O–R) framework and uses an integrated model (see Figure 2) in which servicescape elements (stimuli) influence customer perception (organism). Customer perception is then expected to influence customer satisfaction and loyalty (responses) (Bitner, 1992; Durna et al., 2015).

## **2. Methodology**

### **2.1. Research design**

The proposed model and hypotheses were empirically tested using a quantitative research design. The authors relied on the existing literature and performed a bibliometric analysis to examine the current state of knowledge (Hair et al., 2019; Sarstedt et al., 2014). We then conducted a cross-sectional survey to gather data. Finally, we analyzed the survey data using PLS-SEM in SmartPLS 3. The model consists of first- and second-order reflective constructs for integrated assessment of servicescape dimensions and customer perception and behavior.

### **2.2. Measurement model specification**

The items for the constructs were adapted from prior studies (Kang et al., 2019; Larasati et al., 2022; Roy et al., 2019; Tombs & McColl-Kennedy, 2003; Wu et al., 2018) and were measured on a five-point Likert scale. The model contains two second-order reflective constructs: (a) physical servicescape (PS), which consists of five first-order constructs (Ambient Conditions, Spatial Layout, Facility Aesthetics, signs and symbols, and Cleanliness), and (b) social servicescape (SS), which includes both Employee Social Servicescape and Customer Social Servicescape. The four first-order constructs measured were (a) intelligent servicescape (TE), (b) customer perception (PE), (c) customer satisfaction (SA), and (d) customer loyalty (LO). The model estimated second-order constructs using the repeated indicators approach (Hair et al., 2022).

### **2.3. Sampling and data collection**

Nonprobability convenience sampling was used, which is suitable for exploratory PLS-SEM and theory testing rather than for generalizing across a population (Hair et al., 2022). Given the model's complexity—57 indicators and six endogenous constructs—we followed Hair et al.'s (2022) guidance for high-complexity PLS-SEM designs and targeted 200–300 valid responses to ensure adequate statistical power. The authors distributed 778 questionnaires, yielding 399 valid responses after screening. A mixed-mode strategy was used for data collection: in-person surveys at four Vietnamese smart amusement parks (VinWonders Nha Trang, Sun World Ba Na Hills, Asia Park, Dai Nam Wonderland) using digital tablets, and online surveys targeting visitors to other parks across Vietnam.

### **2.4. Data analysis strategy**

The analysis was conducted using SmartPLS 3. Following the guidelines of Hair et al. (2022), the evaluation was performed in two distinct steps: (a) measurement model assessment, including indicator reliability (also referred to as outer loadings), internal

consistency reliability (Cronbach's alpha and composite reliability), convergent validity (AVE), and discriminant validity (Fornell–Larcker and HTMT criteria), and (b) structural model assessment, including collinearity diagnostics (inner VIF), significance of path coefficients (bootstrapping with 5,000 resamples), coefficient of determination ( $R^2$ ), effect size ( $f^2$ ), predictive relevance ( $Q^2$ ), and mediation analysis. Current guidelines for PLS-SEM were used to validate the model. Emphasis was placed on the treatment of second-order constructs and the robustness of mediation pathways.

### 3. Results

#### 3.1. Measurement model assessment

The measurement model was evaluated according to indicator reliability, internal consistency reliability, convergent validity, and discriminant validity, following the guidelines of Hair et al. (2022).

##### 3.1.1. Indicator reliability (outer loadings)

Indicator reliability was assessed using outer loadings. Items with loadings below 0.70 were removed in an initial run, after which the model was re-estimated. In the final model, all remaining loadings fell between 0.709 and 0.895, meeting Hair et al.'s (2022) recommended threshold.

##### 3.1.2. Internal consistency reliability

Internal consistency reliability evaluates the degree to which a group of indicators is associated as a set (Hair et al., 2022; Henseler et al., 2015). This study used two principal criteria: Cronbach's alpha and composite reliability (CR).

**Table 1.** Construct reliability and validity

| Construct                              | Cronbach's alpha | Composite reliability | AVE   |
|----------------------------------------|------------------|-----------------------|-------|
| Ambient conditions (AM)                | 0.776            | 0.856                 | 0.598 |
| Customer–Customer interaction (CC)     | 0.889            | 0.923                 | 0.750 |
| Customer–Employee interaction (CE)     | 0.921            | 0.938                 | 0.718 |
| Cleanliness (CL)                       | 0.906            | 0.927                 | 0.680 |
| Facility Aesthetics (FA)               | 0.882            | 0.914                 | 0.679 |
| Spatial Layout (LA)                    | 0.880            | 0.907                 | 0.582 |
| Customer Loyalty (LO)                  | 0.861            | 0.905                 | 0.706 |
| Customer Perception (PE)               | 0.849            | 0.899                 | 0.689 |
| Customer Satisfaction (SA)             | 0.858            | 0.913                 | 0.779 |
| Signs, symbols, and artifacts (SI)     | 0.877            | 0.911                 | 0.671 |
| Technological attributes (TE)          | 0.874            | 0.908                 | 0.664 |
| Physical Servicescape (PS) (2nd-order) | 0.841            | 0.887                 | 0.611 |
| Social Servicescape (SS) (2nd-order)   | 0.704            | 0.870                 | 0.770 |

Composite reliability (CR) is preferred over Cronbach's alpha in PLS-SEM because it reflects actual indicator loadings (Hair et al., 2022). All constructs exceeded the 0.70 benchmark ( $CR \geq 0.704$ ; see Table 1), supporting internal consistency.

### 3.1.3. Convergent validity (AVE)

Convergent validity indicates the extent to which indicators share variance explained by their construct (Fornell & Larcker, 1981). It is evaluated using the average variance extracted (AVE). An AVE of 0.50 or greater indicates adequate convergent validity. As shown in Table 1, all constructs exceeded this threshold.

### 3.1.4. Discriminant validity

**Table 2.** Fornell-Larcker Criterion

|    | LO    | PE    | PS    | SA    | SS    | TE    |
|----|-------|-------|-------|-------|-------|-------|
| LO | 0.840 |       |       |       |       |       |
| PE | 0.674 | 0.830 |       |       |       |       |
| PS | 0.637 | 0.688 | 0.782 |       |       |       |
| SA | 0.606 | 0.679 | 0.627 | 0.882 |       |       |
| SS | 0.628 | 0.631 | 0.670 | 0.662 | 0.878 |       |
| TE | 0.575 | 0.626 | 0.638 | 0.632 | 0.542 | 0.815 |

**Table 3.** Heterotrait–Monotrait Ratio (HTMT)

|    | LO    | PE    | PS    | SA    | SS    | TE |
|----|-------|-------|-------|-------|-------|----|
| LO |       |       |       |       |       |    |
| PE | 0.787 |       |       |       |       |    |
| PS | 0.749 | 0.811 |       |       |       |    |
| SA | 0.705 | 0.792 | 0.733 |       |       |    |
| SS | 0.805 | 0.810 | 0.858 | 0.846 |       |    |
| TE | 0.663 | 0.724 | 0.744 | 0.727 | 0.675 |    |

#### *Fornell–Larcker criterion*

Discriminant validity is confirmed when the square root of a construct's AVE exceeds its highest correlation with other constructs (Fornell & Larcker, 1981). Table 2 shows that AVE square roots (top values) are greater than interconstruct correlations, confirming discriminant validity.

*Heterotrait–monotrait ratio:* The HTMT criterion tests discriminant validity by comparing between- and within-construct correlations (Henseler et al., 2015). HTMT values below 0.90 support discriminant validity. Table 3 shows all values under 0.90, supporting discriminant validity. Thus, the constructs were distinguishable within the conceptual framework.

### 3.2. Structural model assessment

After the measurement model was found to be satisfactory, the next step was to evaluate the structural model concerning the hypotheses and construct relationships. This part of the evaluation included checks for multicollinearity, assessment of the path coefficients, effect sizes ( $f^2$ ), explanatory power ( $R^2$ ), predictive relevance ( $Q^2$ ), and

mediation analysis. Statistical significance was assessed using bootstrapping with 5,000 resamples (Hair et al., 2022).

### 3.2.1. Collinearity assessment (VIF)

The VIF values ranged from 1.000 to 2.254. All values were below 5.000, indicating no substantial multicollinearity among the constructs (Hair et al., 2022).

### 3.2.2. Path coefficients and hypothesis testing

The proposed research model was evaluated, and seven hypotheses were tested by analyzing path coefficients using PLS-SEM with bootstrapping (5,000 samples). The results were interpreted on the basis of standardized regression coefficients ( $\beta$ ),  $t$  statistics, and  $p$  values.

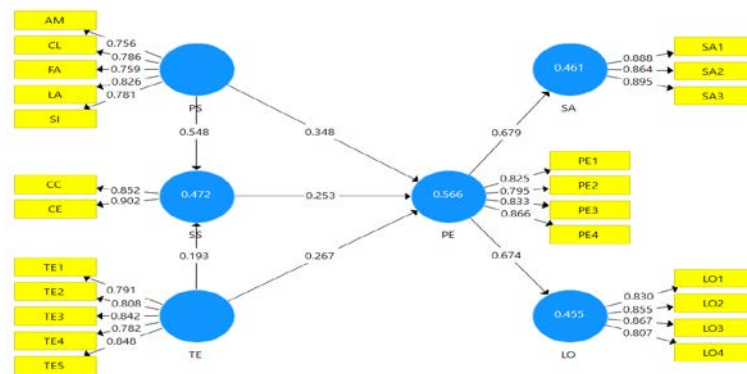


**Figure 3.** Path coefficients and hypothesis testing results

The structural model contains two second-order reflective constructs—Physical Servicescape (PS), which has five first-order dimensions (AM, LA, FA, SI, CL), and Social Servicescape (SS), which has two first-order dimensions (CE, CC). PS and SS were estimated using the repeated indicators approach, retaining only indicators with outer loadings  $\geq 0.708$  (Hair et al., 2022).

*Structural model (final phase of data processing):*

Figure 3 presents the final SEM model, including standardized path coefficients and  $R^2$  values for the endogenous variables.

*Note.* Final SEM model displayed (after removing low-loading indicators AM2, AM3, AM6, and FA5).

*Hypothesis testing results from assessment of direct effects (SEM)*

**Table 4.** Path coefficients and hypothesis testing results

| Hypothesis | Path                | $\beta$ (Coefficient) | $t$    | $p$    | Result    |
|------------|---------------------|-----------------------|--------|--------|-----------|
| H1         | PS $\rightarrow$ SS | 0.548                 | 11.688 | < .001 | Supported |
| H2         | TE $\rightarrow$ SS | 0.193                 | 3.479  | .001   | Supported |
| H3         | PS $\rightarrow$ PE | 0.348                 | 6.466  | < .001 | Supported |
| H4         | SS $\rightarrow$ PE | 0.253                 | 3.932  | < .001 | Supported |
| H5         | TE $\rightarrow$ PE | 0.267                 | 5.258  | < .001 | Supported |
| H6         | PE $\rightarrow$ SA | 0.679                 | 18.592 | < .001 | Supported |
| H7         | PE $\rightarrow$ LO | 0.674                 | 19.053 | < .001 | Supported |

*Note.* Bootstrapping used 5,000 resamples.

All hypothesized paths were shown to be statistically significant ( $p < .05$ ), supporting the hypothesized relationships among servicescape constructs, customer satisfaction, and customer loyalty. Customer perception (PE) had the strongest direct effect on both customer satisfaction (SA) and loyalty (LO), identifying it as a key psychological mediator linking the servicescape to customer outcomes (Durna et al., 2015; Hair et al., 2022).

### 3.2.3. Coefficient of determination ( $R^2$ )

The coefficient of determination ( $R^2$ ) indicates how well the structural model explains the variance of endogenous constructs. Customer Perception (PE) achieved an  $R^2$  of 0.566, suggesting that over 56% of its variance is explained by Physical Servicescape (PS), Social Servicescape (SS), and Intelligent Servicescape (TE). The Social Servicescape (SS) achieved an  $R^2$  of 0.472, driven by PS and TE. Customer Satisfaction (SA) and Customer Loyalty (LO) achieved  $R^2$  values of 0.461 and 0.455, respectively, indicating weak-to-moderate levels of explanatory power (Hair et al., 2022). These results suggest that the components of servicescape strongly explain variation in customer perception (PE) and have moderate effects on LO and SA.

### 3.2.4. Effect size ( $f^2$ )

Effect size ( $f^2$ ) assesses each predictor's contribution to the  $R^2$  of an endogenous construct (Hair et al., 2022). Values less than 0.02 are indicators of no effect; 0.02 to 0.15 are small effects; 0.15 to 0.35 are medium effects; and values above 0.35 are considered large effects (Hair et al., 2022; Sarstedt et al., 2014). As shown in Table 5, customer perception (PE) has a large effect on both Customer Satisfaction (SA) and Customer Loyalty (LO). Thus, it occupies a central role in this model. The Physical Servicescape (PS) has a medium effect on the Social Servicescape (SS) and a small-to-medium effect on PE. The remaining predictors, such as SS and TE, have smaller but meaningful effects on PE and SS.

### 3.2.5. Predictive relevance ( $Q^2$ )

The  $Q^2$  statistic evaluates the proposed model. Its out-of-sample predictive relevance assesses the model's ability to make predictions (Hair et al., 2022).  $Q^2$  values above zero indicate predictive relevance. Values between 0.25 and 0.50 reflect medium predictive power. Values above 0.50 indicate high predictive power. Table 6 shows that all  $Q^2$  values range from 0.318

**Table 5.** Effect size ( $f^2$ )

| Relationship        | $f^2$ | Interpretation |
|---------------------|-------|----------------|
| PE $\rightarrow$ LO | 0.834 | Large          |
| PE $\rightarrow$ SA | 0.854 | Large          |
| PS $\rightarrow$ PE | 0.124 | Small–Medium   |
| PS $\rightarrow$ SS | 0.337 | Medium         |
| SS $\rightarrow$ PE | 0.078 | Small          |
| TE $\rightarrow$ PE | 0.093 | Small          |
| TE $\rightarrow$ SS | 0.042 | Small          |

**Table 6.** Predictive relevance ( $Q^2$ )

| Construct | $Q^2$ | Interpretation          |
|-----------|-------|-------------------------|
| PE        | 0.384 | Medium predictive power |
| SA        | 0.354 | Medium predictive power |
| LO        | 0.318 | Medium predictive power |
| SS        | 0.355 | Medium predictive power |

to 0.384, demonstrating medium predictive relevance for Customer Perception (PE), Customer Satisfaction (SA), Customer Loyalty (LO), and Social Servicescape (SS). These results support the model's robust explanatory and predictive capabilities in smart amusement park contexts.

### 3.2.6. Mediation effects

**Table 7.** Indirect effects and mediation analysis

| Indirect Path                        | $\beta$ | $t$   | $p$    | Interpretation                  |
|--------------------------------------|---------|-------|--------|---------------------------------|
| PS $\rightarrow$ PE $\rightarrow$ SA | 0.236   | 6.375 | < .001 | Strong mediation via PE         |
| PS $\rightarrow$ PE $\rightarrow$ LO | 0.235   | 5.961 | < .001 | Strong mediation via PE         |
| PS $\rightarrow$ SS $\rightarrow$ PE | 0.139   | 3.701 | < .001 | Sequential mediation            |
| SS $\rightarrow$ PE $\rightarrow$ SA | 0.172   | 3.666 | < .001 | PE mediates SS $\rightarrow$ SA |
| SS $\rightarrow$ PE $\rightarrow$ LO | 0.171   | 3.871 | < .001 | PE mediates SS $\rightarrow$ LO |
| TE $\rightarrow$ PE $\rightarrow$ SA | 0.181   | 4.920 | < .001 | PE mediates TE $\rightarrow$ SA |
| TE $\rightarrow$ PE $\rightarrow$ LO | 0.180   | 4.881 | < .001 | PE mediates TE $\rightarrow$ LO |
| TE $\rightarrow$ SS $\rightarrow$ PE | 0.049   | 2.664 | .008   | SS mediates TE $\rightarrow$ PE |

Bootstrapping with 5,000 subsamples was used to assess indirect effects in the mediation analysis (Hair et al., 2022). Mediation is confirmed when  $t > 1.96$  and  $p < .05$ . Table 7 illustrates significant indirect effects operating through Customer Perception (PE) and Social Servicescape (SS). These indirect effects illustrate the pathways proposed in the S–O–R model, linking physical and technological servicescape dimensions with behavior through psychological and social processes.

### 3.3. Discussion

This study extends servicescape theory by combining physical (Bitner, 1992), social (Tombs & McColl-Kennedy, 2003), and intelligent servicescapes (Roy et al., 2019; Yin et al., 2023) into a single, integrated model grounded in the stimulus–organism–response (S–O–R) framework. The results highlight how customer perception plays a key role in translating environmental cues into satisfaction and loyalty (Anderson & Sullivan, 1993; Wu et al., 2018). Applying this model to smart amusement parks—spaces where design, social interaction, and real-time technologies come together—shows how intelligent servicescapes are becoming central to today's visitor experiences. For managers, creating satisfying and memorable experiences requires aligning physical layout, supportive staff, and smart technologies to provide seamless and personalized visitor experiences.

## 4. Conclusion

The results support the integrated servicescape model in the context of smart amusement parks. It was found that physical and intelligent servicescapes have a substantial influence on the social servicescape, indicating that both environmental and technological factors shape interpersonal dynamics. All three servicescape dimensions emerged as positive predictors of customer perception. In turn, customer perception strongly predicts both

customer satisfaction and loyalty. Furthermore, customer perception fully mediates the effects of intelligent servicescape on behavioral outcomes, underscoring its central role.

This research developed and tested an integrated framework that connects the physical, social, and intelligent servicescapes with customer perception, satisfaction, and loyalty in the context of smart amusement parks in Vietnam. By using bibliometric mapping and PLS-SEM analysis of 399 responses, the research emphasizes customer perception as a mediator between the servicescape and both satisfaction and loyalty, providing insight into how complex service environments influence customer behavior. The framework extends servicescape theory and offers an applicable model for managing customer experiences in technology-rich leisure environments.

❖ **Conflicts of Interest:** Authors have no conflict of interest to declare.

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## PHÂN TÍCH THU MỤC VÀ MÔ HÌNH TÍCH HỢP VỀ KHÔNG GIAN DỊCH VỤ TẠI CÁC CÔNG VIÊN GIẢI TRÍ THÔNG MINH Ở VIỆT NAM

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### TÓM TẮT

Hiện nay, các công viên giải trí đang tăng cường việc tích hợp công nghệ vào hoạt động kinh doanh. Trong bối cảnh đó, bài viết này phân tích ba thành phần chính của không gian dịch vụ gồm không gian vật lý, xã hội và thông minh, cùng sự ảnh hưởng của chúng đến việc cảm nhận, sự hài lòng và lòng trung thành của khách hàng tại các công viên giải trí ở Việt Nam. Nhóm tác giả dựa trên khung S-O-R và phân tích thư mục đã xây dựng được mô hình và kiểm định bằng PLS-SEM với 399 phản hồi hợp lệ. Kết quả nghiên cứu khẳng định cảm nhận khách hàng là yếu tố trung gian chính, chịu tác động từ ba yếu tố không gian và ảnh hưởng tích cực đến sự hài lòng, lòng trung thành. Ngoài ra, thông qua tương tác xã hội, không gian dịch vụ thông minh có tác động gián tiếp. Nghiên cứu này cung cấp một mô hình thực nghiệm tích hợp, góp phần mở rộng lý thuyết về không gian dịch vụ. Về mặt ứng dụng, kết quả nghiên cứu cho thấy việc cân bằng giữa các yếu tố thẩm mỹ không gian, tương tác xã hội và công nghệ thông minh là các yếu tố then chốt để tạo nên sự hài lòng và xây dựng lòng trung thành của khách hàng.

**Từ khóa:** không gian dịch vụ thông minh; công viên giải trí thông minh; khung S-O-R