

**Does privacy still matter in smart technology experience? A conditional mediation analysis**

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# Does privacy still matter in smart technology experience? A conditional mediation analysis

## Abstract

Smart technology plays a pivotal role in providing solutions and bringing ease to the travel experience. As many of the technologies are required to collect personal information, it usurps the adoption of technologies. Drawing upon the stimulus-organism-response framework and psychological reactance theory, this study proposed a conditional mediation model to identify the mechanisms driving consumers' behavioural intentions and to tackle their privacy concerns, which could potentially inhibit the growth of smart travel technologies. Of the 435 respondents in China, it was found that their perceived smart travel technologies experience does not affect behavioural intentions directly but has a significant impact on engagement and memorable tourism experience. Mediation analysis revealed that engagement and memorable tourism experience mediated the relationships. Privacy concerns weaken the effects of perceived smart travel technologies experience on engagement and behavioural intentions but not on memorable tourism experience. The indirect effect of perceived smart travel technologies experience on behavioural intentions via engagement was stronger when consumers have low privacy concerns. Theoretical and practical implications are provided for understanding consumer experience towards smart travel technologies in the post-pandemic world.

**Keywords** Smart travel technologies; Travel experience; Privacy concerns; Conditional mediation model; PLS-SEM

## 1.0 Introduction

The impact of smart technologies on the travel industry has been evident for years, making travel more convenient and accessible. To cope with the COVID-19 pandemic, smart travel technologies (STTs) have undergone significant changes to keep the industry running through difficult times (Gössling et al., 2020; Morosan, 2021; Mizrachi and Gretzel, 2020). Examples of the utilization of smart technologies in the travel industry include robotics technologies, contactless payments, virtual reality, augmented reality, artificial intelligence (AI), AI-enabled chatbots and several others (Gursoy and Chi, 2020; Pencarelli, 2019). Many tourism businesses have invested heavily on smart technologies during the pandemic, for instance, the Beijing-based Leyeju Smart Hotel has established a chain of smart hotels to offer completely contactless service with various smart technologies (Stefaniya, 2020; Lau, 2020). Leading hotel brands such as Hilton and InterContinental have rolled out AI-powered chatbots and robotic technologies in their service delivery to improve customer experience (Hotel Management Network, 2023).

The utilization of STTs always grow in tandem with consumer expectation and demand for more intelligent and improving experiences. Various emerging applications that have been developed to address pandemic challenges are likely to coexist with other innovative technologies in order to remain competitive and provide a better customer experience. Notably, the demand and need for smart technologies will continue to grow in order to create more business opportunities to cater individual needs in real-time and optimize resource allocation even after the pandemic is over (Zhao and Zuo, 2021). In addition to assisting businesses with day-to-day operations, several studies highlighted that consumer behaviour towards the use of technology has changed since the COVID-19 pandemic. For instance, Silva et al. (2022) found that Brazilian consumers have changed their behavioural intentions to be more interested in digital services as a result of social influence during the COVID-19 pandemic, which is also believed to have had a significant impact on their future consumer behaviour. In another study by Rangaswamy et al. (2022), customers are more engaged in buying home furnishing products from omnichannel platforms after the pandemic, thereby positively increasing their purchase intentions. Given the pandemic has increased individual preference for contactless technologies, Pillai et al. (2021) also called for more future research to examine individual behavioural intentions, particularly during and after the pandemic.

Prominently, most STTs necessitate the collection of personal data in order to provide consumers with real-time information and solutions (Istepanian and AlAnzi, 2020). Personal information (e.g., location, personal identity or payment details) may be required for these technologies to be more helpful, personalised, and efficient (Feminia-Serra et al., 2022). Despite the high functionality and numerous advantages of using these technologies, information privacy remains a teething problem that obstructs technology adoption and development (Cheah et al., 2022). On one side, a study has discovered that people are sometimes willing to put their privacy concerns aside for the greater good (Geist, 2020). Tourism and hospitality businesses, on the other side, are frequently the main target of cyber-attacks and are highly vulnerable to data breaches because their systems involve many parties, have access to a large amount of customer data, and most of their customers rely on public Wi-Fi networks to use the technologies while travelling (Revfine, 2021; Feminia-Serra et al., 2022). Despite the increasing prevalence of smart technologies, user experience with travel technologies has received little attention in terms of privacy concerns, especially since the outbreak of COVID-19. Therefore, this study also responds to a recent call by Feminia-Serra et al. (2022) for more research to capture privacy issues related to the use of STTs as a result of the COVID-19 pandemic. Jeong and Shin (2020) also called for further academic investigations concerning different psychological

mechanisms to explain user experience with STTs. Given that user participation is one of the key successes of technology implementation in tourism businesses, it is critical to investigate psychological mechanisms such as engagement and memorable tourism experience (MTE). Engagement has become an important metric in relationship marketing as it drives long-term commitment and increases an individual's behavioural intentions (Lim et al., 2020). MTE represents users' ability to recall or remember their experience and has been identified as a driver of future behaviour (Azis et al., 2020). This study aims to understand how individuals react differently to the use of STTs based on their privacy concerns, resulting in the destruction of participation and their intention to use. Scholars suggest that key components of STTs (accessibility, informativeness, interactivity, and personalization) will enhance individuals' overall experiences (Azis et al., 2020; Lee et al. 2018), therefore comprehending how individuals perceive smart technologies is critical because it reflects their decision-making behaviour (i.e., behavioural intentions), which is a precursor to shaping the success of smart technologies in tourism businesses.

To capture the individuals' behavioural outcome, this study employs the stimulus-organism-response (S-O-R) framework (Mehrabian and Russell, 1974) and psychological reactance theory (PRT) (Brehm and Brehm, 2013) to understand and investigate the individuals' perceptions of the use of STTs. Specifically, this study highlights how perceived smart travel technologies experience (PSTTE) can promote engagement, MTE, and behavioural intentions (BI) as well as explore the mediating effects of engagement and MTE in the model. By conducting conditional mediation analysis, we also posit privacy concerns as a moderator that could either strengthen or weaken the direct and indirect effects of PSTTE on engagement, MTE and BI.

Based on the aforementioned, we contribute to existing knowledge in three ways. First, we offer a novel framework for a deeper understanding of the direct effect of PSTTE on engagement, MTE and BI as well as mediating effects of engagement and MTE in the context of STTs. Second, we perpetuate the STTs literature by incorporating privacy concerns to account for the observed heterogeneity, which is proposed to have a moderating impact on the relationships. Third, the findings would offer actionable insights for tourism businesses on how to leverage smart technologies to adjust, formulate and roll out technology-based strategies by effectively alleviating privacy concerns in the post-pandemic era.

## **2.0 Theoretical background**

### **2.1 Stimulus-organism-response framework (S-O-R)**

Conceptualized by Mehrabian and Russell (1974), S–O–R is a behavioural framework from the psychology field to investigate the influence of atmospheric factors on individual behaviour. The theory refers to the interaction between humans and the environments to which they are exposed, proposing that humans actively act upon their environment rather than passively reacting to it. In human-computer interaction research, the S–O–R model is widely acknowledged as a robust theoretical foundation that illustrates how technological features influence consumer behaviour (Lim et al., 2022a; Wang et al., 2022).

The framework depicts a sequential mechanism in which a stimulus (S) in the environment triggers a behavioural response (R) based on the individual's internal state or organism (O). External factors embedded in market environments are referred to as stimuli. Previous research has found that the presence of the consumer perception channel integration, Internet of Things (IoT), store atmosphere, channel availability, and technology features are all environmental stimuli that have a significant impact on individuals' cognitive and affective states (Cheah et al., 2022; Cho et al., 2018). From the perspective of smart technologies, this study considers PSTTE as a significant stimulus in a travel setting to influence the internal states of consumers.

Organism denotes both cognitive and affective states and intervenes between the stimulus and response of an individual (Davis and Luthans, 1980). Scholars have discussed that individual need for relationships is universal across online and offline settings, wherein 'relationship' usually acts as a psychological mechanism that promotes development in all selling platforms (Kozlenkova et al., 2017). The importance of engagement and MTE is often based on the notion that most individual decisions are influenced by past experiences (Chandralal et al., 2015; Lim et al., 2020). Scholars have acknowledged that behavioural intentions are the best term for predicting an individual's behaviour and that it is the key to technology development (Tang and Zhang, 2020). To enrich the extant literature, we consider both engagement and MTE as the organism factors and BI as the "response" to better comprehend consumer experience with STTs. Refer to Figure 1 for our proposed model.

## **2.2 Psychological Reactance Theory**

Psychological reactance theory (PRT) is often employed to comprehend how people react when their routine or freedom is restricted (Brehm, 1966). Individuals have a tendency to restore freedom of choice when they believe their options are limited, according to PRT (Rosenberg and Siegel, 2018). Existing marketing literature has identified privacy concerns as the primary reason for people's refusal or reluctance to use smart technologies (Martin and Murphy, 2017; Inman and Nikolova, 2017). Individuals with high privacy concerns

are concerned that their data is being over-collected by companies and may be used for unknown purposes (Malhotra et al., 2004). Such a phenomenon can be explained via PRT, for instance, a study by Cheah et al. (2022) discovered that when people deal with psychological barriers such as privacy concerns, they are less likely to trust and engage in omnichannel shopping. Grounding on PRT, this study proposes privacy concerns as a moderator that can provide additional insights into the proposed framework.

[Figure 1 near here]

### **3.0 Hypotheses Development**

#### **3.1 Perceived Smart Travel Technologies Experience**

STTs can enable new forms of human-technology interaction by utilizing various devices and up-to-date information, which may transform consumer experience (Gretzel et al., 2015). Furthermore, STTs are also important for providing reliable information to consumers and service providers, improved decision support, enhanced mobility, and high-quality travel experiences (Liberato et al., 2018). Past studies (e.g., Azis et al., 2020; Lee et al. 2018; No and Kim 2015) have suggested PSTTE as a multidimensional construct with dimensions of informativeness, accessibility, interactivity, and personalization. Informativeness refers to the usefulness, completeness, and trustworthiness of information to assist all participating consumers in making decisions (Ukpabi and Karjaluoto, 2017). Ho and Lee (2007) specify accessibility as how easy can consumers obtain travel information provided by STTs in order to complete transactions and avoid any hassles. Interactivity refers to the extent to which consumers can participate in modifying the form or content of a mediated environment in real time (McMillan et al., 2003; Voorveld et al., 2009; Gao et al., 2010). Personalization improves the criticality and efficiency of decision-making as well as provides tailored information that accommodates consumer needs (Buhalis and Amaranggana, 2015).

Following the implementation of these four dimensions, Vicini et al. (2012) and Gretzel et al. (2015) supported that the primary reason for individuals engaging in any travel technologies is to improve their travel experience. As a result, positive experiences with STTs are expected to improve engagement in a way that strongly guides the individuals' evaluation toward positive feelings (Park and Gretzel, 2007; Hari et al., 2022). The general characteristics of STTs also demonstrate their potential to provide individuals with a pleasurable experience (Jeong and Shin, 2020; Azis et al., 2020; Elshaer and Marzouk, 2022). Thus, it enhances the MTE by facilitating relevant information sharing and real-time communication among all participating consumers. The study by Tukamushaba et al. (2016) has reported individual perception positively influences MTE

because their experience at the destination provides them with the ability to interpret the input received by the body's sensory receptors. Azis et al. (2020) suggested that positive PSTTE is an essential antecedent of pleasure and excitement at the destination because consumers may recognize their STTs experiences as part of the travel experiences that contribute to a general perception of a destination experience. Prior research indicates that individuals who perceived the experience with STTs to be positive are likely to develop positive behaviour (Lee et al., 2017; Um and Chung, 2021). Similarly, we posit that their experience with STTs will affect their BI when visiting a destination. The following hypotheses are developed based on these arguments:

H1. PSTTE has a positive influence on engagement.

H2. PSTTE has a positive influence on MTE.

H3. PSTTE has a positive influence on BI.

### **3.2 Engagement**

Engagement has been identified as an important contributor to relationship marketing because it centers on the development of relationships between businesses and customers (Hollebeek and Macky, 2019; Rather and Hollebeek, 2019). The new interactive and advanced features in STTs enhance consumers' consumption experiences by catering to their specific needs and desires. Therefore, active consumer engagement with STTs is encouraged in order for consumers to use travel products or services and visit the destinations (Schaffers et al. 2011). Existing literature suggests that engagement has an impact on BI (Hollebeek et al., 2014; Kim and Barber, 2022) and fosters a proactive relationship between tourists and service providers (Nejad et al., 2022). This is because individuals' subjective knowledge is typically acquired through their participation in touristic activities, which contributes to decision-making for visit intentions (Sharifpour et al., 2014). Furthermore, the pandemic has brought numerous opportunities for many tourism businesses to actively employ technologies and build stronger rapport with consumers, thereby facilitating positive BI (Rather, 2021). As a result, engaged consumers are expected to have more positive BI when using STTs at the destination. We proposed the following hypothesis:

H4. Engagement has a positive influence on BI.

### **3.3 Memorable tourism experience**

Memorable tourism experience (MTE) refers to an unforgettable and pleasant experience that is remembered happily and recalled positively (Oh et al., 2007; Loureiro, 2014). Every individual may engage in similar activities at the same destination, but the level of memorability can be varied depending on their past experience and standard, thus causing a different experience evaluation (Kim, 2018). This is because MTE

does not necessarily represent positive experiences (Sthapit, 2013). Kim (2018) found that travel is an experience-based product, thus having memorable and pleasant experiences with the STTs are the key variables that drive consumer behaviour. In addition, MTE has recently drawn attention to the concept of evolved tourism experiences; for instance, several studies have found that MTE influences consumer attitude at a destination (Jiang et al., 2022; Kim, 2018; Jamshidi et al., 2021). The availability of STTs may influence the memorability of consumer experiences by enabling them to acquire pertinent information while travelling or interact with the available tourism resources at the destination. According to the existing literature, the impact of STTs applied to destinations also revealed a significant positive relationship between consumer experiences with STTs and their intentions to return to the destination (Jeong and Shin, 2020; Jung et al., 2020; Zhang et al., 2018). Based on this notion, we propose the following hypothesis:

H5: MTE has a positive influence on BI.

### **3.4 Mediating effect of engagement and memorable tourism experience**

Engagement can be further explored and incorporated as an important mediator in the context of STTs, in response to the recommendations made by Harmeling et al. (2017), Liu et al. (2018) and Azis et al. (2020). Empirical evidence has shown that engagement is one of the important mediators in a technology-mediated environment because it allows consumers to have control throughout the process (Zhang et al., 2018) and leads to positive BI (Oliveira et al., 2016; Harrigan et al., 2018). For a consumer to be involved or engaged, he or she must have been motivated by certain features of the technologies (Chua et al., 2015). As a result, varying levels of engagement may influence their perceived experience towards the use of technologies. In the process of using STTs, a positive experience with STTs is a significant contextual cue that triggers consumers to engage dynamically, thereby eventually shaping their long-term behaviour.

Considerable evidence in other contexts has explored MTE as an important mediator that influences BI (Jiang et al., 2022; Zhang et al., 2018; Huang et al., 2019). For example, Huang et al. (2019) reported that MTE has a mediating effect between perceived value and BI in food tourism. A study by Jiang et al. (2022) on augmented reality tourism has found that MTE mediates the relationship between individual attitude and their AR experience. While in the case of STTs, PSTTE has been shown to have a direct influence on MTE (Azis et al., 2020). Hence, research on the mediating effect of MTE is needed in order to capture the psychological mechanism that contributes to the explanation of the relationship between PSTTE and BI. We postulate that consumers have good experience with the STTs if they develop engagement and MTE, thereby they will have more positive BI. Drawing from this notion, the following hypotheses are proposed:



H6. Engagement mediates the relationship between PSTTE and BI.

H7. MTE mediates the relationship between PSTTE and BI.

### **3.5 Moderating effect of privacy concerns**

As the technology-mediated environment requires personal data and location sharing for better services and experience, privacy concerns may be the reason some individuals are reluctant to embrace smart technologies (Inman and Nikolova, 2017; Femenia-Serra et al., 2022). Many STTs require consumers to reveal and track the places they go and how far they travel, which is often unrealized by consumers (Masseno and Santos, 2018). The pool of data is not only stored by the device itself, but it is also transferred to a cloud service that consumers have no control over (Julicher and Delisle, 2018).

Previous research has identified that privacy concerns influence individual behaviour in a positive and negative manner. For instance, privacy concerns are found as a significant factor that influences consumers' intentions to use online platforms (Huang et al., 2020) as well as merchants' resistance to adopting mobile payment services (Liébana-Cabanillas and Lara-Rubio, 2017). Scholars have also proposed that it may moderate the association between the factors influencing consumer behaviour in the contexts of online accommodation booking (Femenia-Serra et al., 2022), omnichannel shopping (Cheah et al., 2022), and travel booking (Talwar et al., 2020).

Accordingly, consumers with high privacy concerns may react negatively and feel threatened by STTs that collect massive amounts of data (Martin and Murphy, 2017). Such concerns would reduce their engagement when they feel doubtful, lead to an unpleasant experience as well as deter their intentions to use (Morosan and DeFranco, 2015; Jeong and Shin, 2020; Pentina et al., 2016). Based on this discussion, the following hypotheses are proposed:

H8a: Privacy concerns moderate the relationship between PSTTE and engagement, wherein the relationship is stronger when privacy concerns are low.

H8b: Privacy concerns moderate the relationship between PSTTE and BI, wherein the relationship is stronger when privacy concerns are low.

H8c: Privacy concerns moderate the relationship between PSTTE and MTE, wherein the relationship is stronger when privacy concerns are low.

### **3.6 Control variables**

Prior studies suggest that the adoption of technologies-based services is influenced by demographic factors (Humbani and Wiese, 2018; Khalilzadeh et al., 2017). For example, Choudrie et al. (2018) argued that each consumer embraces technology differently, with age being further identified as a significant predictor of use (Khalilzadeh et al., 2017). Younger people are more likely to use smart technologies as they grew up in a high-tech society (Lim et al, 2022b). Consequently, we controlled for the possible influence of age on BI in this study.

## **4.0 Methodology**

### **4.1 Survey Development and Sampling**

The data were collected over six months in China between April and October 2021 using one of the largest online survey platforms in China (www.wjx.cn). Participants must fulfil the following important criteria to participate in the study: (1) they must have travelled in China within the last two years and (2) they must have used any of the listed STTs in China during their trip. The definition and examples of STTs were provided at the beginning of the questionnaire. The questionnaire was developed in both English and Chinese versions using a back-to-back translation by bilingual experts, as suggested by Brislin (1970).

The online survey resulted in 500 responses, but 43 were discarded because of failing to meet the screening questions of the sampling and 22 were eliminated due to straight-lining issues. The final dataset of 435 observations provided an effect size of 0.15 and a power level of 80% in the post-hoc power analysis (Hair et al., 2022). The sample primarily consisted of female travellers (57.5%) aged 31 to 35 years old (28.1%), travel purposes based on leisure (47.1%), and travel length of 4 – 6 nights (52.4%), with Baidu Maps being the most used smart technology (63.2%) (Table 1).

**[Table 1 near here]**

### **4.2 Measures**

All measurement items were adapted from the extant literature (No and Kim, 2015; Criado and Such, 2011; tom Dieck et al., 2018; Oh et al., 2007; Lwin et al., 2007; Lin and Hsieh, 2007) and modified to fit the STTs context (see Appendix 1). These items were measured using a seven-point Likert scale anchored by 1 = strongly disagree to 7 = strongly agree and were validated through two preliminary tests. We first carried out a pre-test with a panel of ten information technology and tourism professors in China who regularly used STTs. During the test, they were invited to cross-check the sentence structure and language that were unclear,

ambiguous, or unanswerable sentences and language. After some minor changes, the revised questionnaire was pilot tested on 50 target respondents, who were asked to study as well as answer each item carefully. Some items underwent minor changes in terms of wording, as suggested by respondents based on the results of the two preliminary tests. As a result, the analysis of reliability revealed that all constructs had acceptable reliability ( $> 0.7$ ).

## **5.0 Data analysis**

Partial least square structural equation modeling (PLS-SEM) with SmartPLS4 software was utilized for testing the research hypotheses (Ringle et al., 2022). PLS-SEM also performs well for complex structural models, such as by implementing higher-order constructs (Becker et al., 2023; Sarstedt et al., 2019; Cheah et al., 2023) as well as achieving the causal-predictive goal in this research (Chin et al., 2020). Following Hair et al.'s (2022) recommendation, the data were analysed and interpreted based on a two-stage approach: (i) assessment of the measurement model and (ii) assessment of the structural model. Finally, we also examined the conditional mediation model in PLS-SEM (Cheah et al., 2021).

### **5.1 Common method bias**

A full collinearity approach as suggested by Kock and Lynn (2012), was performed to statistically evaluate the degree of common method bias that occurs in our study. The result shows that the variance inflation factor (VIF) values fall between 1.060 to 3.228 (below the threshold value of 3.3; Kock and Lynn, 2012), thus this evidence indicates that common method bias is not a severe issue in this study.

### **5.2 Assessment of measurement model**

As shown in Table 2, all the loading values were above the 0.70 threshold (Hair et al., 2022). Additionally, all the constructs with Cronbach's Alpha (CA), rho\_A, composite reliability (CR), and average variance extracted (AVE) passed the recommended values of 0.70 and 0.50, respectively (Hair et al., 2022), confirming the convergent validity of all constructs. Discriminant validity was then performed using the heterotrait-monotrait ratio of correlations (HTMT) technique (Franke and Sarstedt, 2019; Ringle, Sarstedt, Sinkovics, and Sinkovics, 2023) as shown in Table 3. The findings showed no discriminant validity issues because they did not exceed the threshold of 0.90 (Henseler et al., 2015).

**[Table 2 near here]**

[Table 3 near here]

### 5.3 Assessment of higher-order construct

This study further extended the procedures provided by Becker et al. (2023) and Sarstedt et al. (2019) to assess the Type 2 higher-order construct (HOC) (reflective–formative). It was first examined using a single global item (i.e., “Overall, I have good experience in using smart technology technologies when visiting China”) (Cheah et al., 2018). The redundancy analysis revealed a path coefficient of 0.859 ( $>0.70$ ), indicating that the sub-dimensions for this HOC explained more than 50 percent of the criterion constructs’ variance. Next, all of the dimensions were checked for collinearity issues and the results revealed that the VIF values were all less than 3.3 (Hair et al., 2022), ranging from 2.705 to 3.152, thus confirming that all the dimensions are distinct. Lastly, the indicators’ outer weight and significance were assessed (Table 4).

[Table 4 near here]

### 5.4 Assessment of structural model

The following stage was to evaluate the structural model to ensure that there was no bias in the regression results due to collinearity issues. At this stage, the collinearity between the exogenous constructs was checked through VIF. As illustrated in Table 5, all VIF values were less than 3.3, which implies that collinearity was not an issue in the structural model of this study (Hair et al., 2022).

A bootstrapping procedure was used with 10,000 subsamples to assess the significance of the proposed model (Becker et al., 2023). The result illustrated that the control variable, age, demonstrated insignificant effects across the model (does not meet  $p < 0.001$ ). Overall, the findings revealed that the hypothesis of PSTTE was found to influence engagement, providing support for H1 ( $\beta = 0.410$ ,  $t\text{-value} = 8.373$ ,  $p\text{-value} < 0.001$ ,  $CI = 0.326, 0.489$ ). Hypothesis H2 was supported, as PSTTE was found to have a significant positive influence on MTE ( $\beta = 0.422$ ,  $t\text{-value} = 9.257$ ,  $p\text{-value} < 0.001$ ,  $CI = 0.344, 0.495$ ). Contradictory to earlier predictions, the results depicted that PSTTE was not significantly related to BI. Thus, H3 was not supported ( $\beta = 0.006$ ,  $t\text{-value} = 0.125$ ,  $p\text{-value} > 0.001$ ,  $CI = -0.067, 0.083$ ). The findings also indicated that engagement had a positive impact on BI, providing support to H4 ( $\beta = 0.066$ ,  $t\text{-value} = 4.617$ ,  $p\text{-value} < 0.001$ ,  $CI = 0.198, 0.415$ ). Finally, MTE also had a positive relationship with BI; thus, H5 was supported ( $\beta = 0.071$ ,  $t\text{-value} = 7.848$ ,  $p\text{-value} < 0.001$ ,  $CI = 0.434, 0.666$ ).

The next step was to evaluate the explanatory power, i.e., coefficient of determination ( $R^2$ ) of the endogenous constructs (engagement, MTE, BI), effect size ( $f^2$ ) and predictive relevance ( $Q^2_{predict}$ ). Overall, PSTTE explained 67.5% of the variance in BI, which was considered strong explanatory power (Cohen, 1988). Then it explained 16.8% of the variance in engagement and 17.8% of the variance in MTE, which were considered moderate explanatory power in both cases (Cohen, 1988). Next, the result outlined that MTE ( $f^2=0.327$ ) and engagement ( $f^2=0.1$ ) had medium effect sizes, with MTE being the most important predictor of BI. In contrast, PSTTE ( $f^2=0.000$ ) had a trivial effect size explaining BI. Finally, the predictive relevance was assessed using the  $PLS_{predict}$  (Shmueli et al., 2019). The  $Q^2_{predict}$  values for engagement (0.142), MTE (0.148), and BI (0.586) were all greater than 0, indicating that the model is predictive (Chin et al., 2020; Shmueli et al., 2019). Subsequently, we looked at more precise prediction findings to focus on the key target endogenous items (Shmueli et al., 2019). Table 6 indicates that all endogenous items of the key target endogenous construct, by means of BI, possessed strong predictive power. In particular, the  $Q^2_{predict}$  values for the indicators of the PLS model outperformed those generated for the linear model (LM) ( $Q^2_{predict}$  values  $> 0$ ), while all root mean squared error (RMSE) values for the PLS model were smaller than those of the LM model (Shmueli et al., 2019). To corroborate the result from  $PLS_{predict}$ , this study assessed the cross-validated predictive ability test (CVPAT) that offers a more comprehensive inferential test in predicting our key target endogenous construct (Sharma et al., 2022). Based on Table 6, our proposed model has strong predictive power than indicator average and linear model benchmarks. Therefore, it was established that the proposed model has a strong predictive ability on our key target endogenous construct, by means of the BI.

[Table 5 near here]

[Table 6 near here]

### 5.5 Assessment of mediation effect

Next, this study examined the proposed mediation paths between PSSTE on BI via engagement (H6) and MTE (H7). The result shows that both H6 ( $\beta=0.125$ ,  $t$ -value=4.182,  $p$ -value $< 0.001$ , CI=0.074 to 0.191) and H7 ( $\beta=0.234$ ,  $t$ -value=5.702,  $p$ -value  $< 0.001$ , CI=0.158 to 0.318) were found significant. In addition, since the direct effect of PSSTE on BI was insignificant, hence full mediation is achieved for both engagement and MTE (Nitzl et al., 2016). Therefore, H6 and H7 were supported (Table 5).

### 5.6 Assessment of moderation effect

For moderator assessment, the interaction terms between the predicting variables were tested using a two-stage approach (Becker et al., 2018; 2023). The findings demonstrated that the interactions between PSTTE\* privacy concerns ( $\beta=-0.117$ ,  $t\text{-value}=2.600$ ,  $p\text{-value}<0.01$ ,  $CI=-0.172,0.092$ ) on engagement, and PSTTE\* privacy concerns ( $\beta=-0.113$ ,  $t\text{-value}=2.260$ ,  $p\text{-value}<0.001$ ,  $CI=-0.175,0.105$ ) on BI were significant, indicating that H8a and H8b were supported. However, H8c was rejected because PSTTE\* privacy concerns ( $\beta=-0.090$ ,  $t\text{-value}=1.836$ ,  $p\text{-value}=0.029$ ,  $CI=-0.123, 0.076$ ) on MTE was insignificant (see Table 5).

The significant findings of H8a and H8b were further evaluated using an interaction plot (Becker et al., 2023). Figures 2 and 3 depict the positive relationships between PSSTE and engagement, as well as PSTTE and BI, which were stronger for the low privacy concern group than for the high privacy concern group, supporting H8a and H8b.

**[Figure 2 near here]**

**[Figure 3 near here]**

## **5.7 Index of Conditional Mediation**

The existence of conditional mediation is associated with the presence of a moderation relationship between the links that establish the indirect effect of PSTTE on BI via engagement and MTE (Cheah et al., 2021). The value of the moderating variable, privacy concerns, determines the indirect effect. A formal test of conditional mediation, namely the index of conditional mediation (Cheah et al., 2021), must be performed to evaluate this conditional process model.

As depicted in Table 7, the conditional mediation effect on engagement was found as the confidence interval did not include zero (95% CI: -0.101 to -0.013), indicating the indirect effect of PSTTE on BI through engagement depending on levels of privacy concerns, which supported H8a. However, there was no indirect effect of PSTTE on BI via MTE because the confidence interval included zero (95% CI: -0.084 to 0.052), therefore H8c was not supported.

As the index of conditional mediation indicated the existence of a conditional mediation effect (H8a), it is necessary to further examine the indirect effect at representative values of the moderator (shown as conditional indirect effect) to determine whether mediation exists (or does not) (Cheah et al., 2021). This technique is also known as spotlight analysis (Cheah et al., 2021). Table 8 illustrated that when the level of privacy concerns was low, the effect of privacy concerns on the mediation relationship of PSSTE to BI via engagement was

higher (effect:0.351; 95% CI: -0.251 to 0.444). In contrast, the effect of privacy concerns on the mediation relationship of PSSTE to BI via engagement became weaker when there was a moderate level of privacy concerns (effect: 0.298; 95% CI: 0.232 to 0.361), and weakest (effect: 0.246; 95% CI: 0.158 to 0.325) when the level of privacy concerns was high.

[Table 7 near here]

[Table 8 near here]

## 6.0 Discussion

With their growing prevalence and accessibility, it is believed that the industry is highly dependent on STTs, especially in the post-pandemic world. Heeding the call by Jeong and Shin (2020) and Femenia-Serra et al. (2022) to understand the psychological mechanisms that explain consumer experience with STTs as well as privacy concerns that impact consumer experience around STTs would help businesses to adjust and formulate new strategies. The findings of this research provide meaningful contribution to the extant literature in few ways. First, the study developed a research model by two established theories (S-O-R framework and psychological reactance theory) to understand the comprehensive features and values of using STTs. Notably, the findings revealed that there were significant direct effects of PSTTE on engagement and MTE (i.e., H1 and H2 were supported). In line with studies by Park and Gretzel (2007) and Hari et al. (2022), when STTs are able to demonstrate the potential to fulfil consumer needs, they will have a more positive experience, which encourages them to engage more with the technologies. As prior studies suggest (Azis et al., 2020; Jeong and Shin, 2020), the positive experience provided with STTs will deliver a joyful and memorable experience to consumers. Inconsistent with the finding of Lee et al. (2018), the feeling and experience of consumers using the STTs would not directly influence their BI towards the technologies (H3 was rejected). This implies that their intentions to use STTs are not directly motivated by the benefits they received; instead, they seek other desired outcomes such as engagement or a memorable experience during the process. As suggested by past findings (Nejad et al., 2022; Kim and Barber, 2022), engagement is found to positively influence their BI towards STTs (H4 was supported), indicating that engagement is a significant psychological factor that motivates individuals to use smart technologies and a key factor driving their long-term commitment. We also identify the positive effect of MTE on BI (H5 was supported) which is similar to the finding by Jeong and Shin (2020) who reported that when consumers had positive emotions and memories at the destinations, their BI will be enhanced. As such, individuals' intentions to use STTs are highly dependent on the memorable and pleasant experiences they developed while using STTs during their trips.

Second, we investigated the psychological mechanisms such as engagement and MTE, with the notion that if consumers have a good experience with the STTs, their engagement and MTE will develop, resulting in positive BI. As previously discussed, maintaining a good customer relationship, such as engagement, is imperative in the online and offline environment, and is more likely to result in positive BI among consumers (Oliveira et al., 2016; Harrigan et al., 2018). Our result revealed that engagement and MTE are important mechanisms that significantly mediate the relationship between PSTTE and BI (H6 and H7 were supported). Responding to the call of Azis et al. (2020) to examine MTE as a mediator, it is evidenced that consumers are more likely to have positive BI when they have pleasant memories of experiencing the STTs at the destination.

Finally, this study empirically tested the moderating role of privacy concerns, contributing to a better understanding of consumer behaviour and psychological barriers in responding to STTs. The exploration of individual differences, which is rooted in the PRT, provides a new perspective in this study. As the findings revealed that H8a and H8b, were both supported, they were further confirmed using an interaction plot (Becker et al., 2023). Both H8a and H8b were found to be stronger for the low privacy concern group than the high privacy concern group, implying that consumers with low privacy concerns are more likely to engage with and use STTs, and vice versa. As evidenced by scholars' initial explorations (e.g., Femenia-Serra et al., 2022; Cheah et al., 2022), high privacy concern group of technology consumers tend to feel doubtful and alarmed about their privacy on STTs, they may feel distracted and unengaged during their travel, which influences their BI on the STTs at the destination. Another possible reason for the different levels of privacy concerns among consumers could be the growing awareness of poor data governance by technology-based service providers. However, consumers do not carry any privacy concerns when their PSTTE influence their MTE (H8c was rejected). This study contributes to the understanding that if the STTs emphasize the purpose of providing a memorable experience, consumers are unconcerned about privacy issues. As a result, this study suggests that STTs providers should implement more features that provide memorable and pleasant experiences in order to delight their consumers.

## **7.0 Implications**

This study offers significant theoretical and practical implications. The conditional mediation model in this study offers more nuanced insights than the mediation model or moderation model alone. Building upon the S-O-R model, this present study expands the literature by examining the critical roles of the two mechanisms (i.e., engagement and memorable tourism experiences) in the STTs context. Previous literature has ultimately



assumed homogenous individual behaviour across the adoption of smart technologies without accounting for individual differences. Hence, this study adds value to this stream of research by applying PRT to examine the moderating role of privacy concerns when consumers encounter STTs, deepening our understanding across different groups of consumers when the technologies require them to share personal data.

Practically, this research provides critical insights and assists travel businesses and providers in regaining their recovery and increasing their competitiveness in the post-pandemic world. Notably, STTs may become more widely used and reliant in the future as the industry adapts to reduce physical contact and labour costs (Morosan, 2021; OECD, 2020). With the important direct and indirect influences of engagement and MTE on BI, marketers will need to create travel programs and technologies that can deliver these experiences. They should carefully implement and manage the STTs at their destinations, focusing on the needs and experiences of consumers. The benefits of adopting STTs at the destinations should be advertised and highlighted in marketing communication and promotion materials. For example, promoting and focusing on how the STTs trigger memorable and engaging experiences. In turn, it may encourage consumers to recall their memories of previous visits. Moreover, this practice will push their consumers to establish positive intentions prior to their visit. This notion is not only useful for motivating consumers to develop favourable BI, but it also promotes the adoption of STTs amongst travel businesses.

Privacy concerns must be addressed adequately in order to alleviate the psychological barriers that hinder the use of STTs. For instance, some traditional businesses have inadequate computer and network security, making them highly appealing to hackers (Cobanoglu and Demicco, 2007). Consumers with high privacy concerns are reluctant to share their personal data and real-time location or perform money transactions at these destinations. Smart technology providers need to gain customer confidence by opting for third-party assurance seals to ensure the security of their sensitive data. Some traditional travel-related businesses (e.g., souvenir stores/kiosks, and traditional food and beverage restaurants) have limited resources and access to financial support. Policymakers could provide financial support and technical training to them for constantly improving and updating the technologies, which would act as a market catalyst that could stimulate their further growth. Technology providers must always be aware of the importance of protecting consumers' data privacy by implementing privacy-enhancing technologies in order to provide assurance to the public.

## **8.0 Limitations and suggestions for future research**

Our study focused on the application of a behavioural psychology model of consumer experience with smart technologies. Therefore, this study has limitations that present opportunities for future research. First, our study was conducted in Mainland China; therefore, the findings may not be generalized to represent all countries. Future research could extend the theoretical framework of this research to a different cultural context, such as the Western context, where personal privacy is highly valued. Second, future research might analyse the consumer experience with STTs longitudinally. It would be fascinating to examine if consumer perceptions change because of previous experience. Finally, we measured consumers' BI rather than their actual behaviours. Future research can collaborate with technology providers to conduct field studies to better measure cooperative behaviour.

**Data Availability Statement:** Data is available upon reasonable request by contacting the corresponding author.

**Declarations:**

**Conflict of interest:** On behalf of all authors, the corresponding author states that there is no conflict of interest.

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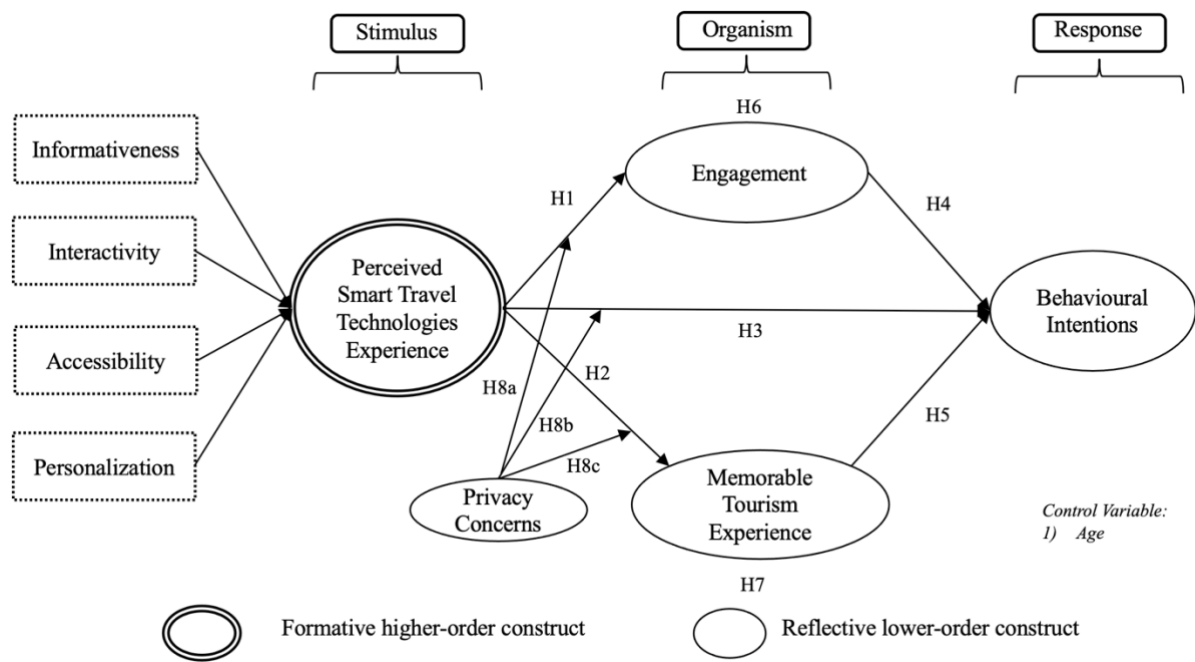
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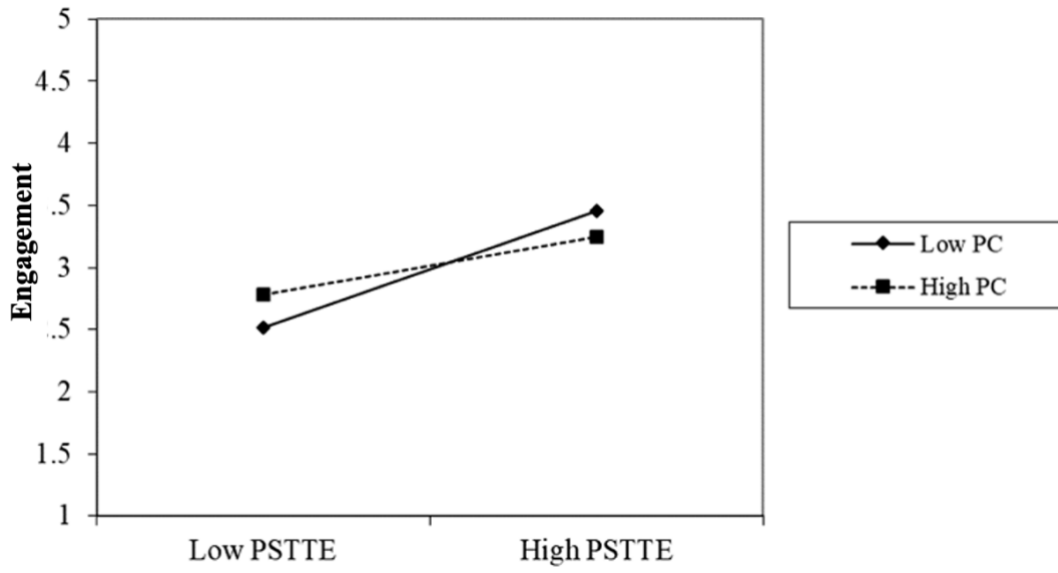
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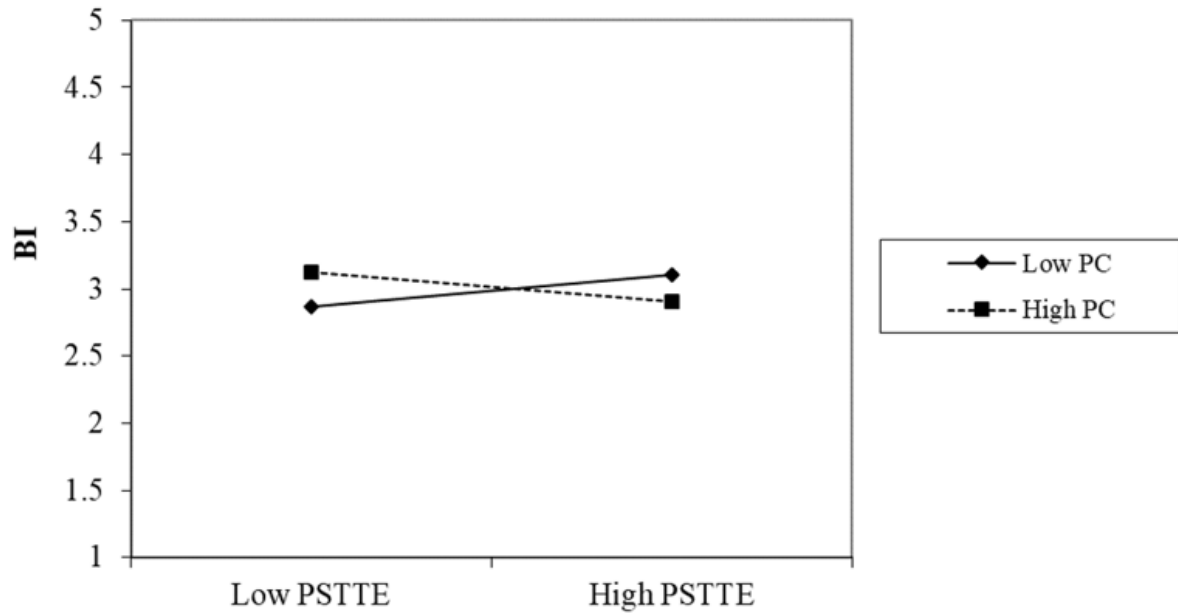


**Fig. 1.** The proposed research model.





**Fig. 2.** Interaction plot of PSTTE\*Privacy concerns on engagement.



**Fig. 3.** Interaction plot of PSTTE\*Privacy concerns on BI.

**Table 1** Demographic Profile (n=435).

Demographic Profile	Category	Frequency	Percentage (%)
Gender	Male	185	42.5
	Female	250	57.5
Age	25 years old & below	64	14.7
	26-30 years old	95	21.8
	31-35 years old	122	28.1
	36-40 years old	81	18.6
	41-45 years old	49	11.3
	46-50 years old	17	3.9
	51-55 years old	7	1.6
Travel purpose	Leisure	205	47.1
	Bleisure	55	12.6
	Business	166	38.2
	Leisure with other purpose	3	0.7
	Business with other purpose	3	0.7
	Others	3	0.7
Travel length	1-3 nights	127	29.2
	4-6 nights	228	52.4
	7-9 nights	58	13.3
	More than 9 nights	22	5.1
Five most popular smart travel technology	Navigation (e.g., Baidu Maps, Google Maps)	275	63.2
	Mobile/Cashless Payment	255	58.6
	Artificial Intelligence	142	32.6
	City Tour Apps	121	27.8
	Facial Recognition	101	23.2
Total		435	100

**Table 2** Assessment of reliability, convergent validity, and full collinearity.

Construct	Item	Loading	CA	rho_A	AVE	CR	FC
Informativeness	INF1	0.946	0.914	0.917	0.854	0.946	2.552
	INF2	0.905					
	INF3	0.920					
Accessibility	ACC1	0.891	0.802	0.813	0.719	0.884	2.490
	ACC2	0.754					
	ACC3	0.891					
Interactivity	INT1	0.938	0.790	0.875	0.711	0.877	2.599
	INT2	0.924					
	INT3	0.630					
Personalization	PSN1	0.851	0.823	0.824	0.738	0.894	2.881
	PSN2	0.888					
	PSN3	0.838					
Engagement	E1	0.912	0.915	0.915	0.855	0.946	0.855
	E2	0.942					
	E3	0.919					
Memorable Tourism Experience	MTE1	0.921	0.935	0.936	0.837	0.954	3.228
	MTE2	0.933					
	MTE3	0.913					
	MTE4	0.893					
Privacy Concerns	PC1	0.932	0.945	0.959	0.857	0.960	1.077

	PC2	0.919					
	PC3	0.923					
	PC4	0.929					
Behavioural Intentions	BI1	0.921	0.933	0.933	0.881	0.957	2.296
	BI2	0.954					
	BI3	0.941					

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Note: D = deleted due to low loading; CA= Cronbach's Alpha; AVE = Average Variance Extracted= Composite Reliability; FC=Full Collinearity.

**Table 3** Assessment of the Discriminant Validity using HTMT.

Construct	1	2	4	5	6	7	8	9
1. Accessibility								
2. Behavioural Intentions	0.414							
3. Informativeness	0.867	0.343						
4. Interactivity	0.890	0.354	0.792					
5. Memorable Tourism Experience	0.437	0.856	0.409	0.387				
6. Privacy Concerns	0.193	0.155	0.106	0.123	0.166			
7. Personalization	0.874	0.358	0.793	0.894	0.457	0.052		
8. Engagement	0.440	0.812	0.401	0.384	0.866	0.167	0.435	

**Table 4** Assessment of higher-order construct.

Higher-Order Construct	Lower-Order Construct	Outer Weight	t-value	Confidence Interval	VIF	Convergent Validity
Perceived Smart Travel Technology Experience	(i) Informativeness	0.316	26.441**	(0.294, 0.342)	2.789	0.859
	(ii) Interactivity	0.254	27.621**	(0.237, 0.273)	2.757	
	(iii) Accessibility	0.277	26.556**	(0.257, 0.298)	3.152	
	(iv) Personalization	0.277	24.899**	(0.254, 0.299)	2.705	

Note: \*\*p < 0.001; VIF (Variance Inflation Factor).

**Table 5** Assessment of structural model.

Relationship	Std Beta for Direct effect	Std Beta for Indirect effect	Std Error	t-value	p-value	BCa CI		VIF	$f^2$	R <sup>2</sup>	Q <sup>2</sup> <sub>predict</sub>
						LB	UB				
H1) PSTTE -> E	0.410		0.049	8.373	0.000	0.326	0.489	1.000	NA	0.168	0.142
H2) PSTTE -> MTE	0.422		0.046	9.257	0.000	0.344	0.495	1.000	NA	0.178	0.148
H3) PSTTE -> BI	0.006		0.045	0.125	0.450	-0.067	0.083	1.238	0.000 (T)	0.675	0.586
H4) E -> BI	0.304		0.066	4.617	0.000	0.198	0.415	2.856	0.100 (M)		
H5) MTE -> BI	0.554		0.071	7.848	0.000	0.434	0.666	2.891	0.327 (M)		
H6) PSTTE -> E -> BI		0.125	0.030	4.182	0.000	0.074	0.191				
H7) PSTTE -> MTE -> BI		0.234	0.041	5.702	0.000	0.158	0.318				
H8a) PSTTE*PC -> E	-0.117		0.045	2.600	0.000	-0.172	-0.092		0.008		
H8b) PSTTE*PC -> BI	-0.113		0.050	2.260	0.000	-0.175	-0.105		0.032		
H8c) PSTTE*PC ->MTE	-0.090		0.049	1.836	0.029	-0.123	0.076		0.015		
<i>Control Variable</i>											
Age -> BI	0.051		0.040	1.266	0.072	-0.013	0.085				

Notes: VIF (Variance Inflation Factor); Effect size ( $f^2$ ): T =Trivial, S=Small, L=Large; PSTTE: Perceived Smart Travel Technology Experience; E: Engagement; MTE: Memorable Tourism Experience; BI: Behavioural Intentions; PC: Privacy Concerns

**Table 6 Assessment of  $PLS_{predict}$  and CVPAT**

Assessment	Item	PLS RMSE	LM RMSE	PLS-LM RMSE	$Q^2_{predict}$	Decision of predictive power
$PLS_{predict}$	BI1	1.188	1.192	-0.004	0.326	Strong
	BI2	1.181	1.185	-0.004	0.304	
	BI3	1.216	1.219	-0.003	0.313	
Assessment	Focus on BI	PLS-SEM loss (M1)	Benchmark loss (M2)	Difference (M1-M2)	p-value	Decision of predictive power
CVPAT	CVPAT benchmark indicator average (IA) construct	0.595	1.006	-0.411	0.000	Strong
	CVPAT benchmark linear model (LM) construct	0.595	0.602	-0.007	0.001	

**Note:** BI indicates Behavioural Intentions

**Table 7** Index of Conditional Mediation.

Mediator	Index	SE(Boot)	LB	UB
Engagement	-0.052	0.024	-0.101	-0.013
Memorable Tourism Experience	-0.020	0.035	-0.084	0.052



**Table 8** Assessment of conditional indirect effect on engagement.

Mediator	Moderator	Effect	BootSE	95% BCa CI	
				Boot LLCI	Boot ULCI
Low Engagement	(-1 SD of PC) -1.001	0.351	0.050	0.251	0.444
Moderate Engagement	(Mean of PC) 0.000	0.298	0.032	0.232	0.361
High Engagement	(1 SD of PC) 1.001	0.246	0.043	0.158	0.325