Role of Smart Tourism Technology in Heritage Tourism Development

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Abstract

This study investigates the role of smart tourism technology (STT) attributes (accessibility, informativeness, interactivity, and personalisation) in creating a positive STT experience, influencing tourists' intentions to revisit, thus benefiting the image of a heritage site. A conceptual model was developed by formulating key reasoning from the elaboration likelihood model (ELM) and flow theory. Four hundred samples were collected from four national heritage sites in India to test the model. The results indicated that the STT role is critical in developing tourists' STT experience and revisit intention, with STT attributes representing the central route of elaboration tending to play a stronger role. This study discusses results across age (old/young) and gender (male/female) with theoretical implications that could also contribute meaningful insights to marketers, government bodies, and corporations involved in tourism development. Importantly, the emergence of STT and the dimensions of the heritage site image are discussed from a sustainability perspective.

Keywords: natural heritage tourism development; smart tourism technology; elaboration likelihood model; flow theory; STT experience; revisit intention; heritage site image

Introduction

Recently, smart tourism technology has become a differentiating factor in the tourism sector (Huang, Goo, Nam, & Yoo, 2017; Tussyadiah et al., 2018). "Smart tourism" is a destination's capacity to adopt integrated technology platforms to benefit tourists and other stakeholders (Buhalis & Amaranggana, 2015). Here, "smart" refers to the provision of easy accessibility to tourists. Notably, previous research finds that Smart Tourism Technology (STT) can enhance the explorative and exploitative use of smart tourism (Huang et al., 2017), support tourists in making travel decisions (Yoo, Goo, Huang, Nam, & Woo, 2017), and enable tourists to share memorable experiences (Jeong & Shin, 2019). Although smart technology attributes play a crucial role in heritage tourism, they have received limited research attention, with STT in heritage tourism development yet to be explored.

STT has recently improved its functionality, bringing more resources and benefits to visitors (Yoo et al., 2017), leading to long term benefits such as destination revisits (Pai, Liu, Kang, & Dai, 2020). One important factor driving destination revisits is the technology-oriented experience of a visitor (Pai et al., 2020); hence, it is surprising that there are very few studies exploring the role of technology-oriented experience in tourism studies (Bastidas-Manzano, Sánchez-Fernández, & Casado-Aranda, 2021). Previous studies exploring this conclude that visitor experience differs based on the type of technology adoption (Thinyane, 2010). Similarly, STT can enable a different experience comprising both utilitarian and hedonic features.

Notably, while the importance of technology-based experience is well documented in contexts other than tourism, the same cannot be said for STT in heritage tourism. Jeong and Shin (2019) recommend investigating the role of technology-based experience on destination image—a measure reflecting tourists' perceptions of a destination after visiting (Becken, Jin, Zhang, & Gao, 2017). Lu, Chi, and Liu (2015) use three important dimensions to measure heritage site image: tourism environment, social environment, and value (value is mostly economic and information tourist benefits). Lu et al. (2015) also emphasise the importance of empirically investigating the impact of heritage site images on future behaviours (e.g., revisit intention).

Thus, the following gaps exist practically and theoretically: (1) the role of STT attributes (in heritage tourism) and their relationship with tourists' intention to revisit a site; (2) the role of STT experience in adding to tourists' image of a heritage site (Jeong & Shin, 2019); and (3)

the dynamic between destination image and revisit intention should be explored (Lu et al., 2015) with a wider lens (heritage site) and a different set of dimensions (tourism environment, social environment, and value). Notably, these dimensions can introduce sustainability into the investigation (Kristjánsdóttir, Ólafsdóttir, & Ragnarsdóttir, 2018; Moreno-Gené, Sánchez-Pulido, Cristobal-Fransi, & Daries, 2018). Besides these three gaps, most tourism researchers have generalised their results across age and gender groups. However, some studies have found that an individual's behavioural intention and attitudes can differ across gender (Wang, Zhou, Jin, Fang, & Lee, 2017) and age (Rather & Hollebeek, 2021). Therefore, we propose two research questions.

> RQ1: What is the role of STT attributes, STT experience, and revisit intention in enhancing heritage site images?
> RQ2: How do the relationships among STT attributes, STT experience, revisit intention, and heritage site image differ with age and gender?

This study postulates its arguments from the elaboration likelihood model (ELM), flow theory, and literature concerning destination image. The STT attributes are conceptualised under central and peripheral routes formulated through the ELM (Petty & Cacioppo, 1986). Next, the STT experience concept is based on the tenets of flow theory (Csikszentmihalyi, 1990). Thus, the results concerning STT experience can add to existing flow theory knowledge. Importantly, the investigation of STT and heritage site image dimensions proposed in this study will expand research about sustainable tourism development (Kristjánsdóttir et al., 2018; Moreno-Gené et al., 2018; Pan et al., 2018), with specific attention to heritage tourism. Besides the core theories, this study positions its arguments through the lens of R-F-M (Recency-Frequency-Monetary) and TCE (Transition Cost Economics) paradigms, thus adding more value to these theories from STT and sustainable angle. While adding value theoretically, this study offers valuable practical implications considering that STT can help stakeholders associated with tourism build sustainable development for the tourism sector (Nunkoo & Ramkissoon, 2016).

Heritage tourism, digitalisation, and sustainability

Preserving a heritage site centrally connects heritage tourism with sustainability (Bec et al., 2019). Recent research focuses on developing sustainable tourism in heritage sites by adopting emerging and immersive digital technologies (Bec et al., 2019). If implemented

correctly, these technologies can enhance the social, economic, and environmental benefits of heritage tourism, both improving endangered heritage sites—thus contributing to community development in heritage tourism (Ocón, 2021)—and eliminating traditional barriers.

While enlarging tourists' experiences, smart technology advancement can also promote better local community development by introducing a new scope for livelihood (Rueda-Esteban, 2019). Advancing STT tools is also being acknowledged as a green economy initiative (Kim, Hlee, & Joun, 2016; Pan et al., 2018), subsequently extending sustainable practices to tourism. In heritage tourism, development areas such as the environment, social benefits, and, importantly, community building must be preserved and, thus, heritage tourism can be deemed sustainable. Here, STT provides a case for developing heritage tourism and contributing to its sustainable measures. Smart tourism capabilities (Buhalis & Amaranggana, 2015) can upgrade the destination image, therefore, providing a competitive advantage from a marketing perspective (Boes et al., 2016). Similarly, Gössling (2017) posits that ICT developments can motivate sustainable development in tourism. Considering this, the four major functions that primarily build STT, accessibility, informativeness, interactivity, and personalisation must be explored (Jeong & Shin, 2020). This study builds its theoretical framework by employing these four attributes, noting that STT can variously benefit tourists, with accessibility being an important benefit.

Theoretical Background

Elaboration Likelihood Model (ELM)

ELM refers to an individual's change in attitude and behaviour based on persuasive communication (Haugtvedt & Petty, 1992). Petty and Cacioppo (1986) explain that communication can involve a high or low elaboration level depending on an individual's approach. An individual can devote more cognitive effort to communicate, referred to as the "central route" or "high elaboration level." In contrast, individuals may not elaborate a message because of the heuristic cues present, referred to as "peripheral cues" or "low elaboration level." Previous research uses ELM to understand visitors' thinking elaboration and its implications for sustainable tourism (MacDonald, Milfont, & Gavin, 2016).

This study fits the four STT attributes within the two routes of the ELM. Here, accessibility and interactivity are peripherally routed, whereas informativeness and personalisation are centrally routed. Namely, accessibility and interactivity enforce less cognitive

effort/elaboration, and informativeness and personalisation enable relatively higher cognitive efforts. Accessibility is understood as an attribute that encourages easy technology use to enhance an underlying objective (Karahanna & Straub, 1999). Therefore, accessibility in STT enables users to make less effort to process information (Huang et al., 2017). Given that accessibility involves less cognitive effort to process using STT, this attribute is proposed under the peripheral route. Similarly, interactivity eases the functionalities for users as STT interactive facilities bestow easy access to tourists. Therefore, these two STT characteristics are proposed as peripheral cues.

Alternatively, informativeness and personalisation involve more cognitive efforts, with previous research finding that informative messages involve more cognitive efforts to process (Book et al., 2018). Thus, as Yoo et al. (2017) note, the quality of information present in an STT must be considered as this can enhance a user's decision based on rational processing. Similarly, personalisation provides more enhanced opportunities to gain tourist opt-in information, motivating tourists to devote more cognitive effort to process it. Rhee and Choi (2020) propose that personalised content in cyber bots/chatbots can involve more cognitive processing from the central route. Thus, both informativeness and personalisation can involve more cognitive processing; hence, these two STTs are categorised under the central route. Most research to date discusses the connection between STT and tourists' experiences (Jeong & Shin, 2020; Pai et al., 2020). However, none connects STT attributes with experience through the ELM theory. Therefore, this study extends conceptual understandings by connecting ELM-STT attributes with STT experience.

STT experience

In this study, experience is defined as a state of flow ("the holistic sensation that people feel when they act with total involvement"; Csikszentmihalyi, 1990, p. 477) that enables users to become absorbed in their activity (Koufaris, 2002). Different branches of experience are used in tourism studies such as technology-enhanced tourism experiences (Dwivedi et al., 2021a; Huang, Gursoy, Zhang, Nunkoo, & Shi, 2021), virtual experience (Hyun, Lee, & Hu, 2009), memorable tourism (Jeong & Shin, 2020), and virtual reality technology (Huang, Backman, Backman, & Chang, 2016). In the context of heritage tourism, the visitors mostly associate their memorable experiences with nostalgic memories (Bapri et al., 2021; Lee et al., 2015). Simultaneously, situated cognition theory (SCT) states that customers' behaviour and judgments are primarily driven by cues in the local environment (Schwarz, 2006). The same

applies to STT attributes and experience. Thus, according to SCT and flow theory, this study conceptualises that STT attributes can enhance STT experience.

Heritage site image

According to Lin et al. (2007), "destination image is defined as the sum of beliefs, ideas, and impressions individuals have of attributes and/or activities available at a destination" (p. 183). Cultural heritage destinations are distinctive among tourism destinations regarding the tourism and social environments in a heritage site. In this study, we define cultural heritage destinations as historical and preserved as national cultural symbols. Lu et al. (2015) propose three variables that formulate heritage destination image dimensions in a heritage site: tourism environment (natural environment and architecture), social environment (community involvement and social convenience—the relationship and support extended in the site), and tourism value (economic and information perception). Accordingly, we can say that the heritage site image connects with tourism sustainability through the following three dimensions: tourism environment (Pulido-Fernández, Cárdenas-García, & Espinosa-Pulido, 2019; Spenceley, 2005), social environment (Moreno-Gené et al., 2018), and tourism value (Kristjánsdóttir et al., 2018). Furthermore, heritage tourism is well observed under the scope of sustainability (Su & Xu, 2016) with the United Nations Educational, Scientific and Cultural Organisation (UNESCO) placing importance on sustainable tourism at UNESCO World Heritage Sites. Therefore, this study seeks to understand the effect of STT experience on heritage site image and, subsequently, on revisit intention.

Revisit intention

The R-F-M paradigm suggests that an individual who has recently and frequently spent money on a product will likely repurchase the product (Hughes, 1995). Through the lens of the R-F-M paradigm, research finds that motivations building positive revisit intentions comprise cognitive and affective components (Li, Cai, Lehto, & Huang, 2010; Zhang, Wu, & Buhalis, 2018). Revisit intention is minimally explored in heritage tourism studies (Hamid, Mohamad, & Suki, 2021). Although previous studies research how past experience affects destination revisits (Huang & Hsu, 2009), no evidence connects how revisit intention is formed alongside technology experience and attributes. While some prior studies support that cognitive and affective destination images influence revisit intention (Song, Kim, & Yim, 2017; Zhang et al., 2018), these studies did not assess heritage site image. Thus, we propose the conceptual model in Figure 1.

<Insert Figure 1 here>

Hypotheses development

Based on the conceptual model (Figure 1), we propose 13 hypotheses.

STT Attributes and STT Experience

Previous studies support that technology attributes such as perceived ease of use and perceived usefulness can enhance user experience (Hornbæk & Hertzum, 2017). The same theoretical understanding can be implied here to argue that technology accessibility can influence STT experience, as research posits that accessibility makes tourists' experiences effortless and is thus key to facilitating a memorable visit (Huang et al., 2017). It is also proposed that technology accessibility travels through the peripheral route, indicating that an individual uses less effort to process the information. Although no study directly identifies how peripheral cues create an experience, one study indicates that visual cues can enhance the experience (He et al., 2018), proposing that STT accessibility can influence the STT experience among heritage site tourists. Thus, we propose:

> Hypothesis 1: Accessibility of STT has a positive relationship with tourists' STT experience at heritage sites.

The interactive features present in STT applications are an emerging attribute (Dwivedi, Kelly, Janssen, Rana, Slade & Clement, 2018; Nunkoo, Gursoy, & Dwivedi, 2020a). Interactivity is another STT attribute that takes the peripheral route. Previous research finds that interactivity in technology can create a user experience (Sutcliffe & Hart, 2017). In the case of tourism STT, the functions available should enable tourists to enjoy the features with little effort. Islam, Jebarajakirthy, and Shankar (2021) find that high website interactivity is positively associated with perceived ease of use, indicating that interactivity can involve less user effort. Therefore, we put forward:

> Hypothesis 2: The degree of interactivity with STT has a positive relationship with tourists' STT experience at heritage sites.

Van Noort, Voorveld, and Van Reijmersdal (2012) find that cognitive processing positively influences a consumer's online flow experience and informativeness and motivation are components of the central ELM route. Thus, this research proposes that informativeness in

STT can positively create STT experience. Aligned with this, Balakrishnan and Dwivedi (2021a) find that cognitive roles can significantly impact user experience. Few studies try to connect how information can enhance experience, but Jeon, Ok, and Choi (2018) find that website informativeness can significantly influence tourists' flow experiences. Based on this, we propound:

> Hypothesis 3: The informativeness of STT has a positive relationship with tourists' STT experience at heritage sites.

Personalisation offers important updates regarding STT adoption and can offer tourists relevant and appropriate STT personalised information. Personalised user updates employ data based on consumers' past behaviours (Zanker, Rook, & Jannach, 2019). Thus, personalisation can elaborate users' search processes travelling through the central route. Previous studies propose that personalisation can induce user experience (Zanker et al., 2019). However, this study extends an ELM understanding focusing on heritage tourism. Thus, we propose:

> Hypothesis 4: Personalisation of STT has a positive relationship with tourists' STT experience at heritage sites.

STT Experience and Heritage site image

This study measures the latent effect of heritage site images through three dimensions: tourism environment, social environment, and value (Lu et al., 2015). Experience is an essential marketing practice toward developing a positive brand image and equity (Iglesias, Markovic, & Rialp, 2019) as consumer's take-away impressions can uplift brand image (Klaus & Maklan, 2007). Experiences through STT can develop positive and satisfying impressions about sites, subsequently building positive associations with heritage sites. Thus, we postulate:

> Hypothesis 5: STT experience has a positive relationship with heritage site image.

STT attributes and revisit intention

As mentioned in the Hypothesis 1 discussions, accessibility is closely related to the convenience that technology provides to its users in terms of effort reduction. Interestingly, Pham, Tran, Misra, Maskeliūnas, and Damaševičius (2018) find that product accessibility tends to influence repurchase intention significantly. Most studies examining revisiting

intention position their arguments from marketing literature specific to repurchase intention (Abubakar et al., 2017), but product accessibility is deemed important to the heritage sector. Hence, we hypothesise:

> Hypothesis 6: The accessibility of STT has a positive relationship with tourists' intention to revisit heritage sites.

Though no studies have linked technology interactivity to tourism revisit intention, relatedly, Shin, Chung, Oh, and Lee (2013) find that website convenience can build positive repurchase intention. Interactive features in STT guarantee a high responsive-feedback mechanism for the tourist user, subsequently reducing the achievement of a perceived goal. Wang, Du, and Olsen (2018) support that interactive feedback mechanisms have long-standing effects such as repurchase intention. With key discussions from marketing literature, this study suggests:

> Hypothesis 7: The degree of interactivity with STT has a positive relationship with tourists' intention to revisit the heritage site.

Wu, Chen, Chen, and Cheng (2014) use the theory of transaction cost economics (TCE) to elaborate that reducing information search costs can lead to repurchase intention. In line with this, tourists can associate with the heritage destinations long-term because the cost of information can be minimised through STT usage. STT provides most of the relevant destination information, saving both transactional and psychological costs and providing tourists with a high level of elaboration (central route). Therefore, we propound:

> Hypothesis 8: The informativeness of STT has a positive relationship with tourists' intention to revisit heritage sites.

Personalisation refers to a customised content approach congruent with user behaviour and can reduce the transaction cost of reuse (Kumar, Smith, & Bannerjee, 2004). Thus, linking the discussion through TCE (Wu et al., 2014), personalisation may lead to better prospects for the destination in question. Notably, Che et al. (2015) found that website personalisation can motivate consumers to revisit a website. Considering this, we hypothesise:

> Hypothesis 9: The personalisation of STT has a positive relationship with tourists' intention to revisit the heritage site.

STT experience and revisit intention

The concept of experience is operationalised from various perspectives such as satisfaction (Chopdar & Balakrishnan, 2020), value (Sandström, Edvardsson, Kristensson, & Magnusson, 2008) and memory (Jeong & Shin, 2020). However, studies related to technology experience follow flow theory to position their arguments (Wu, Chiu, & Chen, 2020). STT experience can provide an enjoyable state to tourists visiting heritage sites as there is a direct relationship between tourism experience and revisit intention (Hosany & Witham, 2010). Notably, Rasoolimanesh et al. (2021) in their research found that memorable tourism experiences can build heritage site revisit intention. Thus, we propose:

> Hypothesis 10: STT experience has a positive relationship with tourists' intention to revisit the heritage site.

Heritage site image and revisit intention

This study conceptualises a heritage site image with three dimensions: tourism environment, social environment, and value (Lu et al., 2015). Su, Hsu, Huang, and Chang (2018) found that satisfaction with setting attributes (the destination's environment settings) can significantly develop positive intentions to revisit. Building on previous literature, we argue that the satisfying attributes within the STT functions can develop positive perceptions and, subsequently, revisit intentions. Thus, we propound:

> Hypothesis 11: The heritage site image has a positive relationship with tourists' intention to revisit the heritage site.

Role of age and gender in the model

Age is an evolutionary process where the cognitive and affective elements can vary across different age groups (Simons, Peeters, Janssens, Lataster, & Jacobs, 2018). Hence, we argue that the relationships proposed in hypotheses 1–11 differ significantly across age groups. Leonidou, Coudounaris, Kvasova, and Christodoulides (2015) found that age can significantly moderate tourism green attitudes and behaviour and Hollebeek (2021) found that customers' service-related experiences related to behavioural intention can be significantly moderated by age. Considering this, we propose:

> Hypothesis 12: Age significantly moderates the relationship shown in hypotheses 1–11

Few studies highlight that tourism behavioural intentions and attitudes differ between male and female groups (Meng & Han, 2018; Nunkoo, Thelwall, Ladsawut, & Goolaup, 2020b). From a technology perspective, male and female groups differ significantly in processing information and building their attitudes (Nunkoo, Hall, Rughoobur-Seetah, & Teeroovengadum, 2019; Wang et al., 2017). According to Wang et al. (2017), STT attributes can be considered within the scope of information processing and elaboration. Thus, we suggest:

> Hypothesis 13: Gender significantly moderates the relationships shown in hypotheses 1–11.

Methodology

Design and data collection

This study follows a single cross-sectional research design with data collected at a single time interval from four natural heritage sites: Taj Mahal, Agra Fort, Group of Monuments at Mahabalipuram, and Great Living Chola Temples (UNESCO, 2020).

We followed a non-probabilistic approach for data collection. Tourists were contacted in person at the heritage site to take part in the survey. The survey was two-phased: first, a qualitative interaction was carried out with the participants, and second, they were asked to complete the study questionnaire.

In the first phase, 6000 tourists from four destinations were screened to participate in the study by these questions:

1. Are you aware of smart technology tools used in tourism? (yes/no),
2. Have you used any smart technology functions during this visit? (yes/no),
3. Do you recognise this tourist site as a UNESCO heritage site? (yes/no),
4. Will you participate in a short survey to share your perception of smart technology and its role in heritage tourism? (yes/no).

A total of 465 tourists responded “yes” to all four questions, based on which they were shortlisted in the survey (phase 2). Of these, 65 tourists who responded to the questionnaire either didn’t answer a question or provided multiple responses in the questionnaire. Thus, 400

samples were usable and subsequently utilised to test the study's model. A small momentum was given as a token of gratitude to each participant. The study was conducted in December 2020, and January and February 2021. As suggested by Jordan and Troth (2020), the following steps were followed to arrive at a CMB free data; (a) randomising the questions in the instrument, (b) scales acquired from different studies, and (c) clarity and understanding of the scales. Also, since the tourists followed all COVID precautionary protocols during their visits, we didn't find any effect of COVID during data collection or observed from tourists way of responding. To check whether data is free from non-response bias, the data collected during the first 25 days (28% of the data) is compared with data collected in the last 25 days (32% of the data). The results showed that there is no significant difference between the two time intervals for any of the item, which confirmed that the data is free from non-response bias. Table 1 provides the respondents' socio-demographic information.

<Insert Table 1 here>

Measures

The survey questionnaire comprised, first, the items of the study constructs (Table 2) and, second, questions about respondents' socio-demographic information. The scales for accessibility, informativeness, interactivity, and personalisation were derived from Jeong and Shin (2020), and the scale for STT experience was derived from Oh, Fiore, and Jeoung (2007) and Jeong and Shin (2020). The scale for heritage site image (tourism environment, social environment, and value) was compiled from studies by Bigné Alcañiz, Sánchez García, and Sanz Blas (2009), Chi and Qu (2008), Lu et al. (2015), and Wang and Hsu (2010). Finally, the scale for revisit intention was derived from Zhang et al. (2018). The scales were measured using a five-point Likert scale; 5=strongly agree and 1=strongly disagree.

<Insert Table 2 here>

Analyses

A two-step structural equation modelling (SEM) technique was employed to investigate the proposed model. During estimation, the indirect effects of the variables were calculated to provide the results. Furthermore, a multi-group analysis tested the difference in estimates between age (young/old) and gender (male/female). The age groups were categorised based on the Plecher (2020) report where Indians' median age is estimated to be 28.4 years. Thus, respondents aged less than 28 years were categorised as young and those aged more than 28

years as older (see Khan, Hollebeek, Fatma, Islam, and Riivits-Arkonsuo, 2020). AMOS version 27 and SPSS version 27 (Arbuckle, 2006) were used to perform the analyses.

Results

Confirmatory Factor Analysis (CFA) and Common Method Bias (CMB)

Table 2 shows that Cronbach's alpha value for all the constructs is above 0.75, confirming reliability (Portney & Watkins, 2000). The factor loadings are above 0.60 and are significantly associated with the latent constructs. Thus, the requirements for content validity are met. Table 3 shows that the AVE (Average Variance Extracted) values are more than 0.50 and inter construct correlation values for each construct are more than their corresponding square root of AVE's (√AVE), satisfying the threshold requirements for convergent and discriminant validity (Fornell & Larcker, 1981), respectively. All validity requirements met the thresholds proposed by Bagozzi, Yi, and Phillips (1991) and Fornell and Larcker (1981) with the fit indices (showing a good fit) of the measurement model presented in Table 4. CMB (common method bias) analysis was performed via the common latent factor (CLF) method (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003); here, the standardised estimates of the CLF model were compared with a non-CLF model to check if there was any difference in values more than the threshold level (0.05). Results found that the differences ranged from 0.002–0.039, thus, satisfying the requirements to confirm that the data is free from CMB (MacKenzie & Podsakoff, 2012).

<Insert Table 3 here>

Structural Model

Figure 2 depicts the results of the structural model. Hypotheses 1–4 investigate the relationships between 4 STT attributes (accessibility, interactivity, informativeness, and personalisation) and STT experience. These four hypotheses were supported. Additionally, the relationship between STT experience and heritage site image was found to be positively significant (Hypothesis 5). Hypotheses 6–9 investigated the relationship between STT attributes (accessibility, interactivity, informativeness, and personalisation) and revisit intention. Except for Hypothesis 7 (interactivity to revisit intention), the relationships were positively significant. Finally, the STT experience relationship (Hypothesis 10) and heritage site image relationship (Hypothesis 11) to revisit intention were positively significant. The R^2 values of the endogenous constructs explained considerable variance and accounted for STT experience (0.237), revisit intention (0.451), and heritage site image (0.167). The fit indices

of the conceptual model are presented in Table 4, where the fit indices' values exhibited a good fit to the model.

<Insert Table 4 here>

Indirect Effects

Table 5 shows the indirect effects of the STT experience and heritage site image, mediating the relationship between STT attributes and revisit intention. The results indicated that the STT experience had a significant indirect effect on the relationship between STT attributes and revisit intention. Among the paths, the highest variance accounted for (VAF) (i.e., 50.93%) was found in interactivity to revisit intention—STT experience accounts for 50.93% of the paths' total effect. However, interactivity fails to create any direct effect on revisit intention. Similar results were found when the relationship between STT attributes and revisit intention was mediated by the STT experience and heritage site image. Furthermore, heritage site image has a significant indirect effect on the relationship between STT experience and revisit intention, with 18.46% of variance accounting for the indirect effect among the total effect.

<Insert Table 5 here>

Multigroup Analysis

Table 6 shows the results of the 11 hypotheses across gender and age groups. For the young age group, except for Hypothesis 7, the remaining hypotheses were positively significant. In the old age group, Hypotheses 6 and 7 were found to be insignificant. The remaining hypotheses were found to be positively significant. The z-score values show a significant difference in the estimates between the young and old age groups. The model's three paths, namely the relationship between informativeness and STT experience, personalisation and STT experience, and personalisation and revisit intention, were significantly different across age groups. Similarly, the relationship between interactivity and revisit intention was insignificant for the male and female groups. Moreover, the path between accessibility and revisit intention was insignificant for males. The z-score for the gender groups exhibited four relationship paths that significantly differed between male and female groups: the relationship between interactivity and STT experience, informativeness and STT experience, personalisation and revisit intention, and heritage site image and revisit intention.

<Insert Table 6 here>

Discussion

This section discusses study results of the hypotheses and compares them with existing literature before examining the theoretical and practical implications.

Hypotheses 1–4 investigate the relationship between STT attributes (accessibility, interactivity, informativeness, and personalisation) and STT experience. The results of Hypothesis 1 support Hornbæk and Hertzum's (2017) proposition that easily accessing technology could significantly influence user experience. The results of Hypothesis 2 are consistent with Sutcliffe and Hart's (2017) argument; this study extends these results from an STT perspective. However, there is no direct evidence to support Hypothesis 3. Jeon et al. (2018) find that website informativeness can significantly influence flow experience among tourists; thus, our results are consistent with related studies. Hypothesis 4 supports Buhalis and Amaranggana's (2015) positions, along with Zanker et al.'s (2019) results that web personalisation could induce user experience. Hypothesis 5's results are consistent with studies investigating the relationship between user experience and destination image (Klaus & Maklan, 2007).

Hypotheses 6–9 investigate the relationship between STT attributes (accessibility, interactivity, informativeness, and personalisation) and revisit intention. However, related studies align with hypotheses 6, 8, and 9's results, such as Pham et al. (2018), reinforcing that product accessibility influences repurchase intention significantly. Hypothesis 8's results are supported by the proposition of the TCE framework (Wu et al., 2014). Hypothesis 7's inconsistent with Lee et al.'s findings (2020) that store interactivity could positively influence store revisit intention. The inconsistent results may be because the interactive options available in STT specific to the heritage tourism cannot be generalised with the technology interactive options available in the retailing format. The result of hypothesis 7 also emphasise that interactivity in STT may not directly lead to revisit intention, but when routed through STT experience. The same can be evidently seen in Table 5. Hypothesis 10's results—tourism experience can positively influence revisit intention—align with previous studies (Hosany & Witham, 2010) and our study extends this understanding to the context of heritage tourism. Chew and Jahari (2014) establish that destination image can build positive revisit intention and Hypothesis 11's results support this except that the heritage site image is considered based on parameters other than cognitive and affective dimensions.

Hypotheses 12 and 13 determine that the model's relationships differ across age and gender groups. Few studies have used age as a grouping/moderating factor in relationships associated with tourism behaviour (Kim, Cheng, & O'Leary, 2007). Against our proposition, only one hypothesis (relationship of personalisation to STT experience) was significantly different among young versus old age groups at a 99% significance level. The difference in personalisation scores may be due to time variations in understanding personalised messages. Similarly, the results of Hypothesis 13 are almost consistent with some related studies. For example, Taylor, Lewin, and Strutton (2011) find that, relatively, females tend to form positive dispositions about social media advertisements based on the informativeness of the ad.

Theoretical Implications

Foremost, this study addresses key gaps in the literature: (1) the results provide comprehensive insights on STT attributes and their relation to revisit intention and STT experience; (2) as per Jeong and Shing (2019), the relationship between STT experience and heritage site image was investigated; (3) the study results contribute majorly to heritage tourism literature, and (4) the results are explored according to age and gender groups. By addressing gaps in the literature, this study extends experiential marketing philosophy to heritage tourism, offering greater understandings of generalising the results in these consumer groups.

While addressing these gaps, this study greatly extends knowledge in heritage tourism literature, bringing new perspectives to ELM and flow theories. Importantly, the role of STT in heritage tourism and the dimensions of heritage site image sets the stage to understand sustainability in heritage tourism from a technology, environmental, social, and economic perspective. Further, this research adds valuable insights regarding ELM and flow theory. Previous studies on ELM have mostly focused on message persuasion and elaboration (Nunkoo, Gursoy, & Dwivedi, 2020a); the present study expands ELM to include the STT framework. Regarding flow theory, we propose an extended terminology, "STT experience." Moreover, this study adds value to the other theories used: the R-F-M paradigm, TCE, and literature relevant to the destination image. For R-F-M, this research broadens its scope by implying that the elements of recency (R), frequency (F), and monetary (M) can be extended using STT attributes. This study also formulates its hypotheses assuming that informativeness in STT can benefit the TCE mechanism. While previous studies limitedly show that

technology can motivate sustainability in tourism (Gössling, 2017; Pan et al., 2018), this research employs STT attributes, finding that they can enhance STT experience and revisit intention. As per previous studies, the results concerning STT attributes can instil a sustainability approach thus extending the available knowledge in ICT and sustainability. Holistically, the model factors extend a positive relationship with the heritage site image, where the dimensions inherit a sustainability angle. Overall, the research provides a comprehensive view that STT attributes and STT experience crucially contribute to the development of long-term sustainable heritage site images.

Practical implications and recommendations

The study results can benefit different stakeholders associated with heritage tourism, such as marketers, government, and technology partners. Marketers can attempt to integrate STTs with social media to enhance the experience of tourists, which can subsequently build a stronger image for tourism.. The study results showed personalisation and informativeness are more important variables in creating experience and developing revisiting intention. Marketers can provide personalised services and informative content in congruent with the heritage location and site to the tourists such as; personalised recommendations using recommendation system, informative pop-ups based on proximity monitoring, personalised notifications, etc.

As governments these days provide consumers with smart application services (Shareef, Kumar, Dwivedi, & Kumar, 2016), they are one step ahead in this virtual arena. More importantly, technology induces a green economy (Pan et al., 2018); so, harnessing STT integration to create sustainable frameworks in heritage tourism is obviously beneficial. Most STT functions are outsourced to local communities and businesses and, thus, can lend to community development—a sustainability angle for heritage tourism. The STT dimensions can be used as a focal lens to view development practices for sustainable cities and tourism—an important component in sustainable development goals (SDGs). Governments and tourism bodies can adopt emerging technologies such as; augmented and virtual reality to build greater experience and develop revisit intention among tourists, which can bring sustainable economic benefit to the heritage tourism.

Limitations and Future Research Directions

This study has some limitations which can be addressed in future studies. Future research can focus on designs other than survey design such as experimental design. Thus, they can pay attention to causality in relationships. The present research employed four STT attributes derived from previous studies; future studies could employ more STT variables for a comprehensive picture of STT. Additionally, future studies can try to understand the diversified attitudes of STT applications based on their functionalities.

Apart from the suggestions above, we propose avenues for future research: (1) integration of STT attributes with any technology-based theory will help researchers enhance the theoretical value, (2) cross-cultural comparison of the present study's framework contributes higher value for heritage tourism researches and practitioners, (3) investigating the governments' initiative to operate STT applications in heritage destinations in developing countries will aid in policy reforming and budget allocations, (4) the conceptual model proposed in this study can also fit other potential frameworks, such as S-O-R and U&G theories (5) the present study model can be extended by providing a dimensional space for cultural variables, helping to further develop the heritage site image, (6) the adoption of emerging technologies such as artificial intelligence (chatbot and voice assistants) and blockchain (Balakrishnan & Dwivedi, 2021b; Dwivedi et al., 2021a; 2021b; Gursoy, Chi, Lu, & Nunkoo, 2019; Hughes et al., 2019) by travel and tourism organisations and tourists should be examined to understand what impact such technologies have on tourism decision-making and enhancing STT experience.

Conclusion

This study proposed a conceptual model to investigate the role of STT attributes in creating STT experience, heritage site image, and revisit intention. Its framework is sculptured through ELM theory, flow theory, destination image, R-F-M paradigm, and TCE theories. The findings result in a valuable contribution to these theories while providing practical insights for various stakeholders involved in heritage development—corporate bodies, the government, and marketers. Overall, we emphasise three important points. First, heritage sites represent a sustainable picture, introducing a new perspective that STT can contribute to the development of heritage sites from a sustainability perspective. Second, STT applications and their functions in heritage tourism must be extended to reap long-term benefits. Third, the heritage site tourism sector must focus on creating an experience by STT applications to build a better image of heritage destinations.

Ultimately, while the heritage tourism industry could become more STT reliant to increase its sustainability image, this is quite a complex undertaking when considering all the variables. Hence, others should reflect on the important findings of this research to make use of STTs (with an understanding of tourist behaviour outlined in this study) to utilise these smart technologies and apply them to smart sustainability approaches that can (as was found here) add value to natural and cultural heritage assets. Further, this aids in increasing tourist awareness, part of the critical mission of sustainable tourism set out by UNESCO.

Declaration of Interest Statement

No potential conflict of interest was reported by the authors.

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Table 1: Study participants' social demographic information			
Socio-demographic		**Frequency N = 400**	**Percentage**
Variables	**Characteristics**		
Gender	Male	226	56.50
	Female	174	43.50
Age	Young (20–28 years)	218	54.50
	Old (29–62 years)	182	45.50
Occupation	Student	176	44.00
	Working Professional	184	46.00
	Businessperson	40	10.00
Education	Under-graduation	156	39.00
	Post-graduation	188	47.00
	PhD	56	14.00
Awareness of STT	Yes	400	100.00
	No	0	0.00
Preferred STT function in the site	Maps and Guide	84	21.00
	Payment system	68	17.00
	Transportation systems	56	14.00
	Tour Bookings	49	12.25
	Virtual tours	42	10.50
	Query system	38	9.50
	Recommendations	34	8.50
	Kiosks	29	7.25
Heritage Sites	Taj Mahal	124	31.00
	Agra Fort	78	19.50
	Group of Monuments at Mahabalipuram	114	28.50
	Great Living Chola Temples	84	21.00

Table 2: Measurement Model Loadings				
Constructs	**Items**	**Mean**	**FL**	**α**
Accessibility	I used smart technology applications anytime and anywhere during the visit.	3.80	0.770***	0.781
	Smart technology applications were easily available to use in the site.	3.64	0.686***	
	In the heritage site, smart technology applications were easily accessible.	3.75	0.754***	
Informativeness	Smart technology applications provided useful information.	3.48	0.805***	0.785
	Smart technology applications assisted me in touring.	3.40	0.670***	
	Use of smart technology applications in the heritage site completed my trip successfully.	3.52	0.767***	
Interactivity	Other users' questions, answers, and reviews were available on smart technology applications.	3.49	0.805***	0.807
	Smart technology applications were highly responsive to users.	3.34	0.740***	
	It was easy to share local information through smart technology applications.	3.31	0.752***	
Personalisation	Smart technology applications allowed me to receive tailored information.	3.28	0.715***	0.823
	I could interact with smart technology applications to get personalised information.	3.09	0.781***	
	The personalised information provided by smart technology applications met my needs.	3.12	0.855***	
STT experience	I had a wonderful experience using smart technology applications during my visit.	3.49	0.841***	0.879
	Smart technology applications made my trip enjoyable.	3.49	0.790***	
	Smart technology applications made my trip beneficial.	3.57	0.760***	
	My experience with using smart technology applications was unforgettable.	3.42	0.847***	
Revisit intention	I intend to visit this heritage site again.	3.45	0.818***	0.803
	I'd love to come to the heritage site again.	3.52	0.724***	
	I think I will come back to the heritage site in near future.	3.48	0.740***	
Tourism environment	The architecture of the heritage site is good.	3.41	0.833***	0.809
	This heritage site has breath taking scenery and natural landscape.	3.46	0.681***	
	This heritage site's gastronomy is good.	3.40	0.807***	
Social environment	Residents in the heritage site are friendly.	3.42	0.773***	0.820
	The heritage site has a convenient transportation system.	3.40	0.754***	
	Businesses around the heritage site offer reliable and consistent service.	3.35	0.805***	
Tourism value	The heritage site has reasonably priced food and accommodation.	3.40	0.810***	0.837
	Obtaining updated tourism information in the heritage site is easy.	3.41	0.763***	
	The heritage site is relatively not that crowded.	3.45	0.820***	
Note: ***denotes $p<0.001$; α=Cronbach's alpha; FL=Factor loadings				

Table 3: Inter-Construct Correlations and AVE values											
	CR	**AVE**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. SE	0.821	0.605	***0.778***								
2. ACC	0.781	0.544	0.154	***0.738***							
3. INF	0.793	0.562	0.097	0.506	***0.749***						
4. INT	0.810	0.587	0.191	0.573	0.591	***0.766***					
5. PER	0.828	0.617	0.102	0.007	0.016	0.051	***0.786***				
6. STTE	0.884	0.657	0.217	0.394	0.448	0.445	0.250	***0.810***			
7. RI	0.805	0.580	0.331	0.419	0.517	0.422	0.323	0.574	***0.762***		
8. TE	0.819	0.603	0.727	0.249	0.093	0.206	0.080	0.222	0.340	***0.777***	
9. TV	0.840	0.637	0.732	0.230	0.105	0.164	0.090	0.245	0.302	0.750	***0.798***

Notes: 1. AVE=Average Variance Extracted; 2. CR=Composite Reliability; 3. Squared root of AVE's are presented in the diagonal for each construct in italics; 4. Abbreviations: SE=Social environment, ACC=Accessibility, INF=Informativeness, INT=Interactivity, PER=Personalisation, STTE=STT experience, RI=Revisit intention, TE=Tourism environment, TV=Tourism value

Table 4: Fit indices results				
Fit Indices	**Measurement Model**	**Structural Model**	**Recommended Value**	**Reference**
X^2	457.770	694.066	Not Applicable	
df	314	336	Not Applicable	
X^2/df	1.458	2.066	≤ 3.00	Kline (1998); Byrne (2010); Hair, Sarstedt, Ringle, and Mena (2012)
GFI	0.945	0.936	≥0.900	
NFI	0.948	0.941	≥0.900	
CFI	0.973	0.956	≥0.900	
RMSEA	0.034	0.052	≤ 0.080	

Table 5: Direct, indirect and total effects in the model				
	Indirect (LLCI, ULCI)	**Direct (LLCI, ULCI)**	**Total (LLCI, ULCI)**	**VAF**
ACC→STTE→RI	0.059^{***} (0.008, 0.127)	0.144^{ns} (-0.001, 0.292)	0.203^{***} (0.048, 0.356)	29.06%
INT→STTE→ RI	0.082^{***} (0.029, 0.150)	0.079^{ns} (-0.054, 0.208)	0.161^{***} (0.021, 0.294)	50.93%
INF→STTE→RI	0.091^{***} (0.036, 0.161)	0.295^{***} (0.150, 0.434)	0.386^{***} (0.244, 0.520)	23.50%
PER→STTE→ RI	0.081^{***} (0.038, 0.132)	0.250^{***} (0.130, 0.370)	0.331^{***} (0.212, 0.442)	24.47%
ACC→STTE→HI→ RI	0.063^{***} (0.009, 0.132)	0.119^{ns} (-0.024, 0.268)	0.182^{***} (0.029, 0.333)	34.61%
INT→STTE→ HI→ RI	0.086^{***} (0.030, 0.155)	0.062^{ns} (-0.071, 0.195)	0.147^{***} (0.011, 0.283)	58.50%
INF→STTE→ HI→ RI	0.094^{***} (0.039, 0.165)	0.308^{***} (0.166, 0.441)	0.402^{***} (0.264, 0.530)	23.38%
PER→STTE→ HI→ RI	0.085^{***} (0.019, 0.139)	0.238^{***} (0.122, 0.355)	0.323^{***} (0.207, 0.433)	26.31%
STTE→ HI→ RI	0.053^{***} (0.019, 0.093)	0.287^{***} (0.136, 0.433)	0.340^{***} (0.188, 0.484)	18.46%
Abbreviations: ACC=Accessibility, INF=Informativeness, INT=Interactivity, PER=Personalisation, STTE=STT experience, RI=Revisit intention, HI=Heritage site image				
Note: ***denotes effects significant at 95% confidence level; ^{ns} denotes effects not significant Number of bootstrap samples for percentile bootstrap confidence intervals is 5000				
Indirect effect—variance accounted for (VAF) is calculated by (indirect effects/(direct + indirect effects)) (Hair et al., 2016)				

Table 6: Multigroup analysis results								
Paths			**Age**			**Gender**		
			Young	**Old**		**Male**	**Female**	
Endogenous Construct		**Exogenous Construct**	**Estimate**	**Estimate**	**z-score**	**Estimate**	**Estimate**	**z-score**
STT Experience	<---	Accessibility	0.225^{***}	0.143^{**}	-0.958^{ns}	0.204^{***}	0.150^{**}	-0.645^{ns}
	<---	Interactivity	0.201^{***}	0.145^{**}	-0.708^{ns}	0.270^{***}	0.104^{**}	-2.069^{**}
	<---	Informativeness	0.230^{***}	0.398^{***}	2.034^{**}	0.184^{***}	0.403^{***}	2.627^{***}
	<---	Personalisation	0.328^{***}	0.137^{**}	-2.607^{***}	0.260^{***}	0.202^{***}	-0.775^{ns}
Heritage Site Image	<---	STT Experience	0.268^{***}	0.228^{***}	-0.439^{ns}	0.280^{***}	0.200^{***}	-0.865^{ns}
Revisit Intention	<---	Accessibility	0.110^{***}	0.061^{ns}	-0.765^{ns}	0.060^{ns}	0.142^{***}	1.314^{ns}
	<---	Interactivity	0.043^{ns}	0.037^{ns}	0.104^{ns}	0.062^{ns}	0.059^{ns}	0.055^{ns}
	<---	Informativeness	0.370^{***}	0.426^{***}	0.865^{ns}	0.402^{***}	0.398^{***}	-0.056^{ns}
	<---	Personalisation	0.295^{***}	0.151^{***}	-2.531^{**}	0.283^{***}	0.143^{***}	-2.483^{**}
	<---	Heritage site Image	0.282^{***}	0.222^{***}	-0.856^{ns}	0.306^{***}	0.166^{***}	-2.034^{**}
	<---	Revisit Intention	0.257^{***}	0.296^{***}	0.515^{ns}	0.297^{***}	0.262^{***}	-0.456^{ns}
Notes: ***p-value < 0.01; ** p-value < 0.05; ^{ns}=not significant								

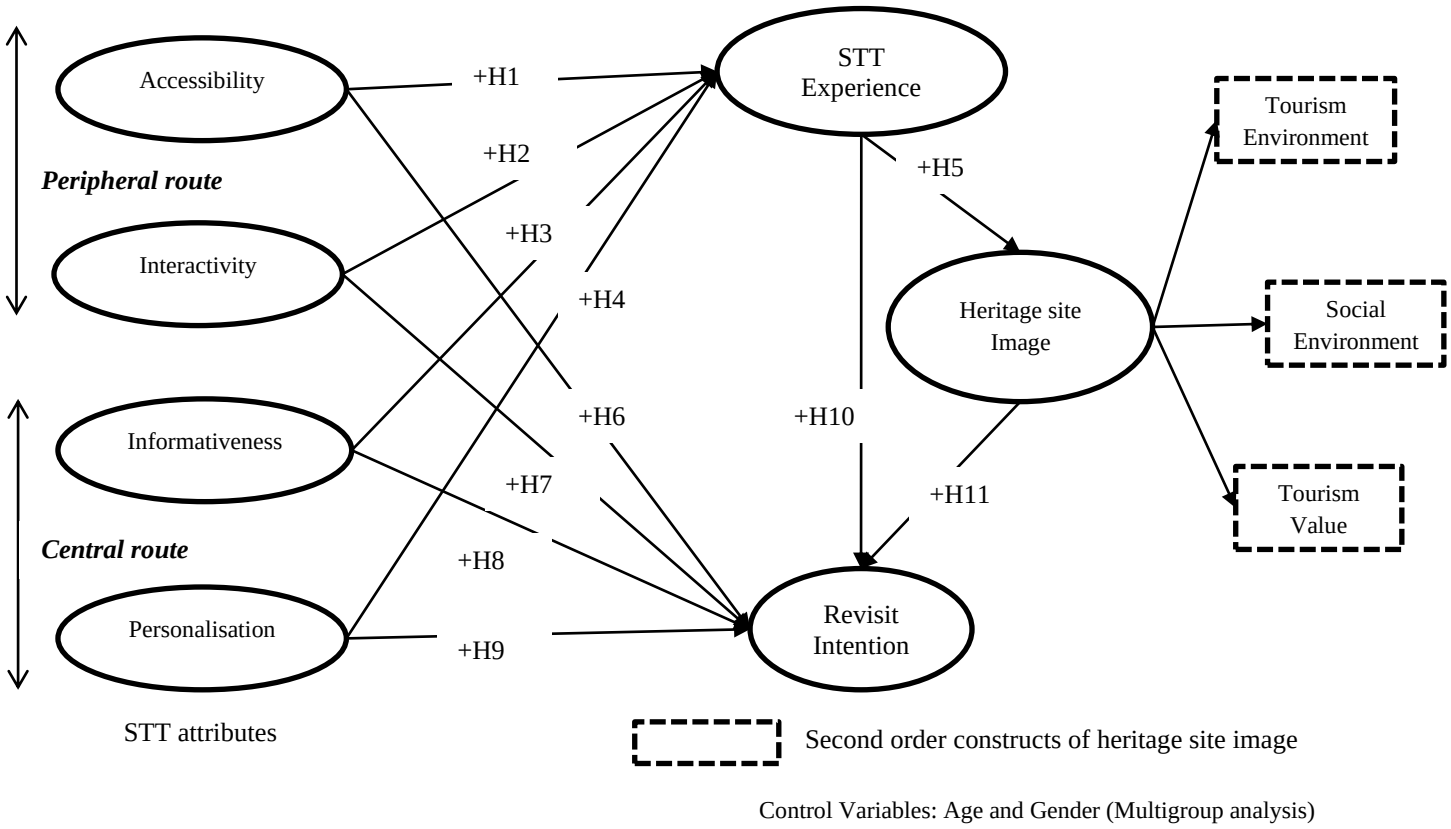
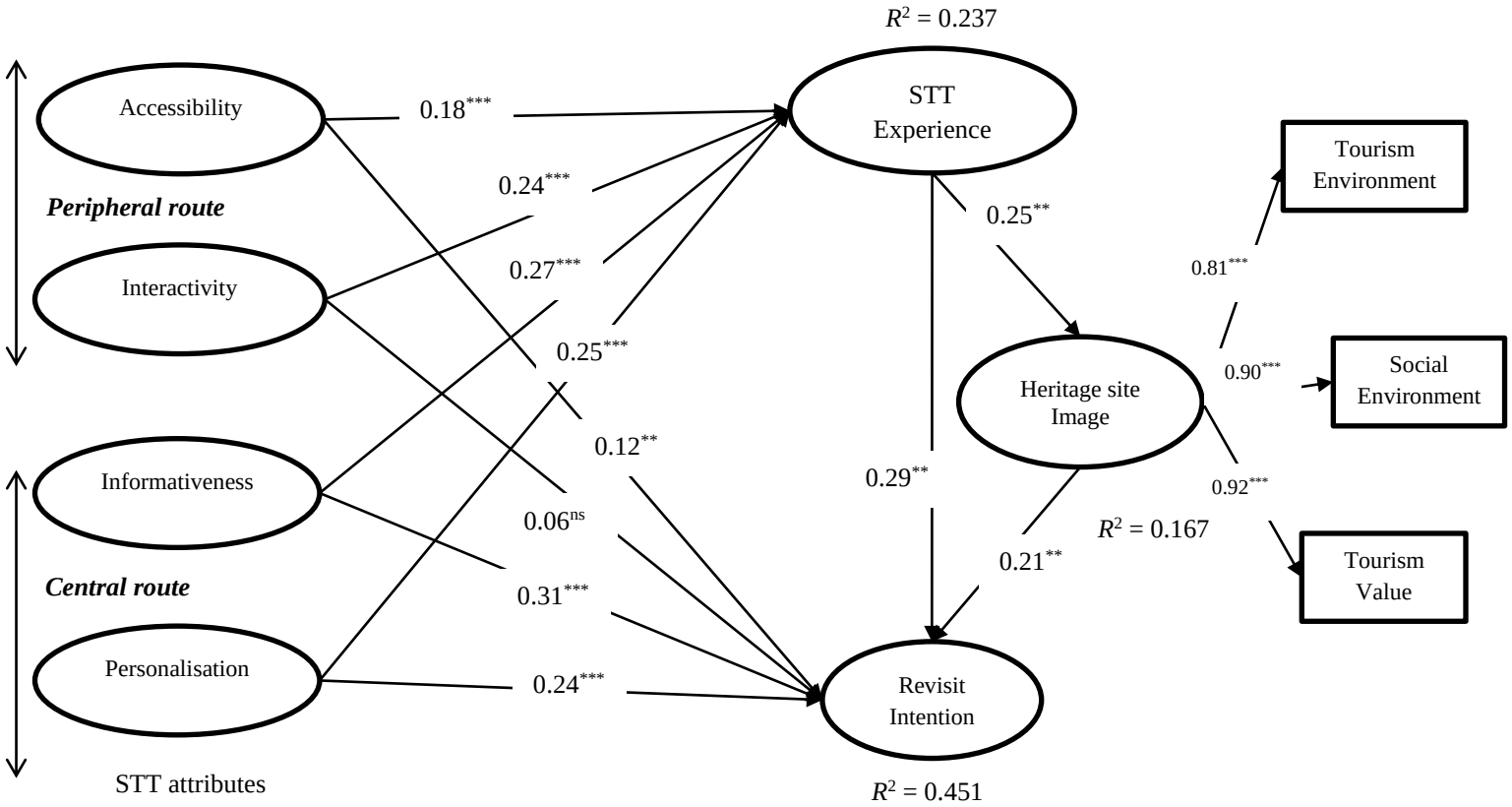


Figure 1: The proposed conceptual model



Note: *** p<0.010; ** p<0.05; ns p= not significant

Control Variables: Age and Gender (Multigroup analysis in Table 6)

Figure 2: Results of the conceptual model