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ORIGINAL RESEARCH ARTICLE

Incorporating perceived responsibility on tourism sustainability in tourist typology through the knowledge gap theory

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ABSTRACT

This study investigates the application of knowledge gap theory in the context of tourism sustainability, examining the perceptions that varying types of tourists have about their own responsibilities to tourism sustainability, with regard to preferences on tourism information and travel modes. This study aims to develop a typology of tourists based on perceived self-responsibility towards tourism sustainability. A mixed-methods approach was employed, starting with the focus group followed by a survey. Data were gathered from three cities, resulting in 864 valid samples for the final analysis. The findings suggested that although most samples endorsed tourism sustainability indicators, obvious disparity was found in perceived self-responsibility across sample groups, particularly among those with a preference for digital information. Four distinct tourist types were identified based on their perceived self-responsibility on tourism sustainability. The results offer crucial insights for policymakers and industry stakeholders in fostering sustainable tourism practices for target tourist segments. By identifying and bridging knowledge gaps and customizing strategies to cater to various tourist demographics, a more responsible and sustainable approach to tourism can be cultivated.

Keywords: tourism sustainability; knowledge gap theory; tourist typology; tourism information; travel mode; perceived self-responsibility

1. Introduction

Sustainable tourism development has emerged as a central concern in contemporary tourism research, as the industry contends with mounting challenges related to environmental, social, and economic impacts. The pivotal role of tourists in this context is increasingly apparent, as their decisions and behaviors directly impact the effectiveness of sustainability endeavors. Gaining a comprehensive understanding of the factors that influence tourist behavior and decision-making processes is crucial for fostering sustainable tourism practices and achieving long-term sustainability objectives. The awareness, attitudes, and actions of tourists play a decisive role in reducing the negative effects of tourism and maximizing its advantages through sustainable practices.

However, according to the knowledge gap theory[1], discrepancies in communication, social networks, and resources have resulted in varying levels of information acquisition and retention among different social

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groups, which widens the knowledge gap. Such information asymmetry can significantly affect the understanding and behaviors of tourists toward tourism sustainability. Recent studies also demonstrated that knowledge gaps may hinder the implementation of effective sustainable practices among tourists[2,3]. These gaps manifest as disparities in the comprehension of tourism on their environmental impact, awareness of sustainable options, and ultimately, their participation in sustainable practices.

Tourist can be categorized according to their preferences, motives, and travel behaviors. Tourism typology is therefore essential for comprehending the varying demands and expectations of different types of tourists[4]. Past studies[5] revealed that ecotourists were more likely than other types of tourists to exhibit environmental awareness and participate in sustainable actions. By examining the link between tourist type and knowledge gaps, communication methods and treatments can be tailored to the specific preferences of each type.

In the era of technology, information plays a crucial role in influencing the decision-making processes and behaviors of tourists. Quality, accessibility, and trustworthiness of information pertaining to sustainable tourism practices and policies are essential for closing knowledge gaps[6]. Research has shown that social media and mobile apps can promote sustainable tourism practices[7,2]. By comparing the efficacy of digital and analog information, researchers may determine the most successful channels for reaching and engaging varied tourist groups, as well as assess the potential of digital technology to improve information distribution and accessibility.

Many elements, such as the knowledge of tourist, motives, and the information they acquire throughout their journeys, impact both in-person and virtual tourism experiences[8]. Virtual tours are found to heighten the understanding of the environmental implications of travel decisions, hence encouraging sustainable behavior[9]. Studying the interaction between acquired knowledge and preference for travel modes hence offers an understanding of how to persuade tourists to embrace sustainable tourism behaviors.

This research seeks to fill the gap in the field of sustainable tourism development by using the knowledge gap theory to investigate the viewpoints of different types of tourists regarding their obligations towards sustainability. Individuals' views are influenced by the particular types of information and means of mobility. This study not only emphasizes the discrepancies in the obligations that tourists believe they have towards themselves but also classifies travelers into distinct groups based on these perspectives. This introduces a comprehensive framework for evaluating and promoting sustainable practices efficiently, with multi-facet considerations on tourist demographics, information-seeking patterns, and travel modes. A mixed research approach, incorporating qualitative and quantitative studies, is applied to the tourists from three cities. The results offer the basis to fill up the gap on how to prevent tourists from obstructing sustainable tourism due to the inappropriate channeling of information.

The significance of this study is in its capacity to improve the development of efficient operational strategies and policies in the tourism sector. The findings provide policymakers and industry stakeholders with useful data that can be used to develop sustainable tourism plans that meet the individual demands of different types of tourists. The findings notably highlight the effectiveness of digital platforms in addressing inequalities in information. This study enriches the theoretical framework of information distribution and sustainable behavior among tourists by employing the knowledge gap theory in the context of tourism. In this respect, the operationalization of tourist typology serves the two main objectives of categorizing tourists according to their level of commitment to sustainability, and improving the strategic emphasis of tourism marketing and communication endeavours. The extensive results of this study offer crucial understanding that can direct future research and strategic development efforts focused on developing a sustainable global tourist economy.

2. Literature review

2.1. Knowledge gap theory

The knowledge gap theory[1] states that due to discrepancies in communication, social networks, and resources, higher socioeconomic groups were more likely to acquire and retain new information. Thus, the knowledge gap between social groups widens with time. Sustainable communication in tourism has been commonly examined conceptually with the theory of planned behavior[10], elaboration likelihood model[11], information processing theory[12], and the construal level theory[13]. The attention pervaded the benefits of green images and the efficacy of sustainability messages, through non-personal and personal communication channels[14]. Nonetheless, the dissemination of knowledge in the areas of environmental, social-cultural, and economic effects of tourism was found to have information gaps[15,16]. These knowledge gaps may hinder the development of sustainable tourism policies and practices.

Munar et al.[2] indicated the usage of social media and smartphone applications might enhance the transmission and accessibility of information. However, it should be noted that information processing was also affected by cognitive capacity, motivation, and prior knowledge[17]. Environmentally conscious and knowledgeable tourists were more likely to adopt sustainable practices and make informed decisions[18], but similar knowledge may be processed and comprehended differently by various types of tourists. The social-cognitive theory states that self-efficacy, or confidence in one's ability, influences behavior[18]. Self-efficacy impacts the sustainable behaviors of tourists[10] when tourism sustainability requires stakeholder participation to close knowledge gaps and develop effective policies and practices[19]. It is therefore necessary to examine if tourists of various types will comprehend the tourism sustainable information at diverging latitudes; and the type of communication channel that can deliver constructive content to enhance the sustainability of tourism.

2.2. Tourist typology

Tourism research uses tourist typology to categorize tourists according to their goals, behaviors, and demographics[20,21]. This strategy assists tourism planners, marketers, and managers in comprehending the demands of tourists. Cohen's tourist typology from 1972 included organized mass tourists, individual mass tourists, explorers, and drifters. This ranking considered prior knowledge about the location, improvisational skills, and trip motivation[22] that helped to understand tourist motivations and travel patterns. Plog's renowned typology categorized tourists based on personality and travel objectives into psychocentric, allocentric, and mid-centric groups[23]. Despite criticism for its simplicity, Plog's typology has contributed to a better understanding of tourist expectations and travel behaviors[24]. The typology of Pearce categorized tourists into six groups based on their travel patterns and behaviors[25] to comprehend the preferences and behaviors of tourists. Crompton's seven-type tourist classification divided tourists into seeking novelty, social connection, cultural experiences, leisure, escape, education, and prestige[26]. Ahola categorized tourists based on their motivations and behavior, in order to understand passengers' motivations and behaviors[27]. The typology by Wang and Pizam[28] classified tourists according to their trip objectives: social interaction, escape, education, leisure, and adventure, and provided insights into tourist motives and actions. While all these typologies provided a better understanding of the tourists, they were all criticized for their oversimplification of tourism or the complexity of tourist behavior.

Beyond the consumer tourist role, the Extended International Tourist Role (EITR) scale investigated psychological variables. The EITR scale measures tourists' psychological roles like cultural ambassadors, explorers, learners, and socializers. By representing their country, cultural ambassadors encourage cross-cultural understanding and respect, adventurers seek thrills, learners seek knowledge, and socializers mix with locals and other tourists[29]. The EITR scale originated with 32 components and has been reduced to 20, with

each component reflecting one of the four psychological roles[30]. It illustrated the complex behaviors and motivations of tourists, which impacts the tourism sector. Tourism organizations should tailor their services based on the psychological characteristics of tourists. The EITR scale may assist destinations in adopting environmentally responsible tourism practices that improve intercultural understanding, environmental preservation, and local economic development[31]. In this research, the EITR scale was used to classify the samples to better comprehend their psychological motives and behaviors.

2.3. Tourism information

Barring analog sources, the internet and the advancement of digital technology have allowed tourists to have access to a large array of travel information. Tourists could choose to access information about the destinations, travel itineraries, lodgings, activities, and transit alternatives through a range of outlets, including travel websites, social media, travel agencies, brochures, and guidebooks. The simplicity and flexibility of finding information online provided competitive advantages, especially when personalized information could be customized based on individual preferences and interests[32]. Social media platforms have also become essential marketing tools for tourism, enabling service providers to reach a larger audience and promote their destinations through user-generated content[33]. Although digital travel information has numerous advantages, analog travel materials, such as brochures and guidebooks, are still valuable resources for tourists, particularly in locations with weak or no internet connections[28]. Analog travel information may also provide tourists with a more immersive experience, enabling them to feel and touch the information in ways that digital information cannot provide.

Generally, digital and analog travel information comes with their respective advantages and disadvantages. In contrast, tourism organizations that provide an admix of digital and analog travel information to customers without considering their preferences make it difficult to yield an optimized return. Therefore, the aforementioned hypothesis was constructed,

H1: Tourist typology significantly correlates with preference of receiving tourism information (a) before the trip; (b) during the trip, in (i) analog, (ii) digital, or (iii) both forms.

2.4. Mode of travel

Economic and technological changes have branded virtual tours as a trendy option, and touring online is a convenient and cost-effective way for tourists to discover countries and experience their destinations before deciding whether to visit[33]. Tourism companies may use online resources to reach a larger audience, promote their destinations, and raise brand recognition[34]. Notwithstanding these advantages, there are numerous drawbacks to online travel experiences. One of the most significant issues was information overload, which occurred when tourists got overwhelmed with the quantity of information accessible and found it difficult to make judgments about their trip. Another issue was the possibility of internet reviews and ratings being altered, resulting in false or biased information[35,36]. Moreover, the possibility that virtual encounters could lessen the demand for in-person travel might harm tourism providers, especially in places that depend significantly on tourism for economic growth[37,28].

According to the literature, tourist typology impacted tourism preferences. Juan et al.[38] discovered that psychocentric tourists chose guided tours and activities they were acquainted with, while allocentric tourists wanted fresh experiences. Tasci and Gartner[39] revealed that tourists looking for adventure favored flexible arrangements that allow for spontaneity and discovery, but tourists looking for security chose organized timetables that reduced uncertainty and risk. Dedeoğlu et al.[40] discovered that allocentric tourists preferred non-standard lodging kinds such as camping, hostels, and homestays, but psychocentric tourists preferred standard accommodation types such as hotels and resorts. This research will expand the coverage to in-person

and virtual travel preferences. The subsequent hypothesis was thus structured.

H2: Tourist typology significantly correlates with a preference for travel modes (i) physical, (ii) virtual, or (iii) both modes.

2.5. Tourism sustainability

Tourism sustainability is the capacity of the tourism sector to satisfy the demands of contemporary tourists and host communities while preserving and increasing possibilities for future generations. Sustainable tourism attempts to limit negative environmental consequences, maintain natural resources, and safeguard cultural heritage while maximizing economic advantages and fostering social well-being[41]. A variety of sustainability indicators have been in place, including the Global Sustainable Tourism Criteria (GSTC), the Sustainable Tourism Stewardship Council (STSC), and the Tourism Sustainability Council (TSC)[42]. Through the collaboration between UNWTO and the UN, the Measuring the Sustainability to Tourism Programme (MST) was introduced to provide a common framework with 23 indicators to measure the sustainability impacts of tourism[43].

Many obstacles and problems impeded the adoption of sustainable tourism techniques. They included the lack of sustainable tourism knowledge and education, lack of political will and leadership, inadequate financial resources, and restricted stakeholder participation. Addressing these issues would need the dedication and participation of a wide range of stakeholders, including governments, corporations, tourists, and communities[42]. Tourists of all types have distinct interests and habits, which might influence the sustainability of tourism sites. Caruana[44] discovered that tourists who were more adventurous and independent were shown to have more favorable opinions towards sustainable tourism practices than mass tourists who were more concerned with comfort and ease. Similarly, Porras-Bueno et al.[45] determined that tourists of various typologies were concerned about the socio-cultural repercussions of tourism. Explorers and cultural tourists were shown to be more interested in conserving local cultures and traditions, while sun and sea tourists were less concerned. Tourist typology has also been related to tourism destination sustainability in terms of resource usage and carrying capacity. Ristić et al.[46] found that adventure-seeking tourists preferred more distant and unspoiled natural regions while comfort-seeking tourists preferred developed places with more services. Based on these findings, the underlying hypothesis was developed.

H3: Tourist typology significantly correlates with tourism sustainability belief, in terms of (a) self-responsibility and (b) support for MST.

H4/5: Preference for tourism information sources/travel modes correlates with tourism sustainability belief, in terms of (a) self-responsibility and (b) support for MST.

Figure 1 illustrates the conceptual and theoretical framework on how the dissemination of tourism information will affect tourism sustainability beliefs and perceptions based on tourist typology.

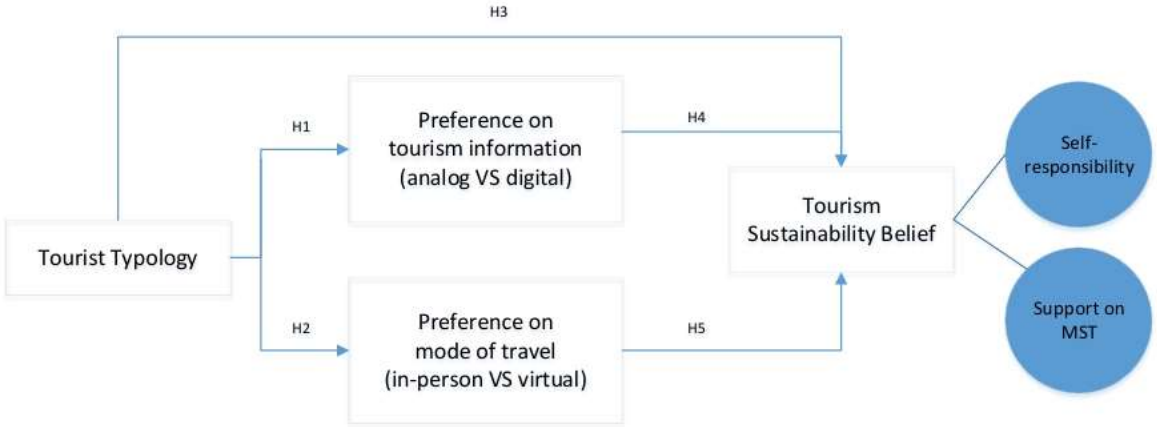

Figure 1. The conceptual framework of how tourist typology will affect tourism sustainability belief with regard to preferences of tourism information and travel modes.

3. Methodology

This research used a mixed-methods approach, starting with a qualitative focus group study followed by a quantitative survey. The focus group discussions samples tour guides, in order to gain insights into their perceptions, experiences, and recommendations in the context of tourism sustainability. The information was analyzed by AMOS 24.0.0, based on the results, past studies, and factual considerations, a questionnaire was developed and data was collected in three cities of the Greater Bay Area (GBA). The quantitative data was then analyzed by SPSS Version 24.

3.1. Survey tools

The questionnaire consisted of five sections covering 80 questions. The sections included screening, demographics, tourism sustainability, preferences on tourism information and travel modes, and tourist typology. The section on tourism sustainability was developed based on the MST indicators released by UNWTO[43] to examine the perception of tourism sustainable responsibility, using a five-point Likert scale from totally disagree (1) to totally agree (5), and the extent of support through a dichotomous scale. The section on preferences of tourism information was investigated through two stages: before and during the trip, covering 10 and nine areas of tourism activities respectively; while the preference for travel mode covered five major areas of tourism at the destination. This part on tourism information has employed three multiple responses, namely analog, digital, and both, indicating a preference for analog, digital, or both types of tourism information; while the part on travel mode also utilized three options, including in-person, virtual or both forms. The section on tourist typology has employed the EITR scale[29] with 22 items, applying a 7-point Likert scale from totally disagree (1) to totally agree (7). The questionnaire was first translated from English to Traditional Chinese by experienced translators and reviewed by three professors, then a mirrored Simplified Chinese version was also developed to accommodate the different types of Chinese languages used in the data collection cities.

3.2. Data collection

The survey was carried out at 13 tourist sites and local residential areas of three cities within the GBA, namely Macao, Zhuhai, and Guangzhou. The data was collected using purposive sampling to achieve a fair distribution of samples among the three cities. A pilot study was carried out and modifications on typos were done. A total of 928 questionnaires were collected both by trained research assistants at the site and online, with a 6:4 distribution. For the survey carried out physically on-site, the rejection rate was 45.7%. One of the reasons for the high rejection rate was health concerns in the aftermath of the pandemic. The online surveys

were carried out using Qualtrics through the snowball method. Amongst all the collected questionnaires, 64 were found to be incomplete or have data inputs, which were removed, leaving 864 samples in the final analysis.

3.3. Data analysis

The reliability of the data was checked by Cronbach Alpha and the constructs were examined by exploratory factor analyses to determine their relevance to the underlying factors. Factors with factor loadings below the threshold were removed and the remaining clusters were investigated by hierarchical cluster analysis to determine the number of clusters, followed by K-means clusters to classify the clusters. The hypotheses were then tested and upon confirmation of the conceptual model, the underlying interactions between tourism sustainability belief and tourist typology were examined.

4. Findings

4.1. Participants

All participants were 18 years or above, with a fair distribution between females (49.1%) and males (50.7%). The majority were college or above (83.9%), distributed among various age groups, 18–24 (35.1%), 25–34 (26.4%), 35–44 (21.6%), and 45 and above (16.9%). More participants were single (55.3%) than married (42.7%), while more do not have children (60.4%) than have (39.6%).

4.2. Reliability

The reliability of the data was checked by Cronbach Alpha and all sections are above the 0.7 threshold (**Table 1**).

Table 1. Reliability of data.

	Cronbach's Alpha	**Items**
Overall	0.907	75
Self-responsibility	0.763	4
Support on MST	0.855	23
Travel information	0.951	19
Travel mode	0.809	7
Tourist typology	0.892	22

4.3. Factor analysis

The constructs are examined by exploratory factor analyses to test the shared variance of the measured variables and their contribution to measuring the factors[36]. Two constructs with factor loadings below 0.5 are removed from the final analysis (**Table 2**). All constructs that remain are above the threshold of 0.7 for composite reliability and 0.5 for both average variance extracted (AVE) and squared multiple correlations (SMC). The AVE measures the construct validity, while the SMC measures the proportion of the variance accounted for by the construct.

Table 2. Exploratory factor analysis, reliability, and validity.

	Constructs	Factor loadings	CA	CR	AVE	SMC
	Socializer (S)		0.876	0.889	0.668	
17.6	Traveling in a foreign country, prefer make friends with the local people	0.884				0.881
17.5	Traveling in a foreign country, prefer to associate with the local people	0.853				0.792
17.7	Traveling in a foreign country, prefer to seek the excitement of complete novelty	0.796				0.521
17.8	Traveling in a foreign country, prefer to live the way the people I visit live	0.729				0.501
	Learner (L)		0.841	0.864	0.615	
18.2	Prefer to engage in activities that challenge my physical being	0.832				0.717
18.1	Prefer to engage in activities that challenge my intelligence	0.830				0.753
18.3	Prefer to engage in activities that provide opportunities for active participation	0.792				0.484
18.4	Prefer to engage in activities that provide opportunities for new experiences	0.673				0.512
	Explorer (E)		0.842	0.870	0.692	
16.2	Prefer destinations that have tourist facilities similar to those of my country	0.894				0.925
16.1	Prefer destinations that have a culture like mine	0.851				0.630
16.3	Prefer destinations transportation systems are like those of my country	0.743				0.501
16.6	Prefer destinations with restaurants familiar to me*	0.475				0.365
	Individual mass tourist (IMT)		0.759	0.792	0.561	
16.4	Prefer destinations with well-developed tourism industries	0.799				0.580
16.5	Prefer destinations that are very popular with tourists	0.766				0.657
16.7	Prefer destinations environmentally friendly	0.676				0.351
17.2	Prefer to start a trip with preplanned or definite routes*	0.498				
	Organized mass tourist (OMT)		0.795	0.826	0.621	
17.3	Traveling in a foreign country, prefer a guided tour	0.891				0.850
17.4	Traveling in a foreign country, prefer travel agencies to take complete care of me, from beginning to end	0.868				0.727
17.1	Traveling in a foreign country, prefer to have international hotel chains	0.563				0.503

AVE = Average variance extracted; CA = Cronbach alpha; CR = Composite reliability; SMC = Squared multiple correlation; *Removed from analysis.

4.4. Cluster analysis

The remained constructs are then examined by hierarchical cluster analysis to determine the number of clusters, followed by K-means cluster analysis. For hierarchical cluster analysis, Ward Linkage is applied to allow the formation of clusters of similar size. Based on the dendrogram, four clusters were identified. Then K-means cluster analysis was employed to classify the clusters and interpret the results through the distance from the cluster centers through 19 iterations. All *F*-values of the constructs are found to be significant at $P < 0.01$ (**Table 3**). The four clusters classified are namely (1) individual mass tourists, (2) socializers, (3) learners, and (4) organized mass tourists. As per **Table 4**, individual mass tourists (IMTs) are tourists who prefer tourist destinations with familiar culture, touristic facilities, and transportation systems, and the destination should be well-developed and environmentally friendly. As for socializers, this type of tourist likes to connect with the

local people of the tourism destination and live the local life, while they tend to seek excitement and novelty. Learners are tourists who prefer to participate in activities at the tourist destination that can provide them with new experiences and challenges. Organized mass tourists (OMTs) prefer to stay at international hotel chains, join guided tours, and have travel agencies take care of the arrangements.

A full description of each construct is shown in **Table 2**.

Table 3. ANOVA of the constructs after K-means clustering.

Constructs[1]	Cluster		Error		*F*	Sig.
	Mean square	df	Mean square	df		
16.1	330.592	3	1.806	860	183.058	0.000
16.2	374.362	3	1.585	860	236.185	0.000
16.3	383.563	3	1.640	860	233.926	0.000
16.4	187.570	3	1.748	860	107.307	0.000
16.5	208.120	3	1.682	860	123.711	0.000
16.7	165.650	3	1.605	860	103.237	0.000
17.1	141.346	3	1.705	860	82.904	0.000
17.3	266.684	3	1.997	860	133.521	0.000
17.4	352.546	3	2.091	860	168.615	0.000
17.5	159.859	3	1.075	860	148.706	0.000
17.6	186.631	3	1.145	860	162.991	0.000
17.7	179.177	3	1.281	860	139.886	0.000
17.8	103.300	3	1.006	860	102.639	0.000
18.1	305.265	3	1.484	860	205.737	0.000
18.2	337.391	3	1.699	860	198.621	0.000
18.3	193.969	3	1.091	860	177.776	0.000
18.4	133.655	3	1.067	860	125.297	0.000

Table 4. Tourism attributes of the four clusters under tourist typology.

TT	Tourism attributes
IMT	Prefer destination with familiar culture, touristic facilities, transportation systems, being well-developed, popular and environmentally friendly
S	Like to associate with locals and live like the locals, seek excitement and novelty
L	Prefer to actively participate in activities that provide new experiences and challenges
OMT	Prefer to join guide tours, be cared for by travel agencies, and live in international hotel chains

IMT = Individual Mass Tourist; L = Learner; OMT = Organized Mass Tourist; S = Socializer; TT = Tourist Typology.

4.5. Hypotheses testing and new tourist typology

The hypotheses were examined by Pearson Correlation and all are supported, except Hypothesis H1b.i on the correlation of tourist typology on the preference of receiving analog information during the trip (**Table 5** and **Figure 2**).

Table 5. Hypotheses testing results.

Hypotheses			***r***	***P***	**Findings**
H1	**TT → TI**				
Before trip	Analog	H1a.i	0.118**	0.000	Supported
	Digital	H1a.ii	−0.225**	0.000	Supported
	Both	H1a.iii	0.160**	0.000	Supported
During trip					
	Analog	H1b.i	00.010	0.777	Rejected
	Digital	H1b.ii	−0.098**	0.004	Supported
	Both	H1b.iii	0.083*	0.014	Supported
H2	**TT → TM**				
	In-Person	H2i	−0.073*	0.031	Supported
	Virtual	H2ii	−0.116**	0.001	Supported
	Both	H2iii	0.137**	0.000	Supported
H3	**TT → TS**				
	Self-responsibility	H3a	0.125**	0.000	Supported
	Support on MST	H3b	0.193**	0.000	Supported
H4	**TI → TS**				
Before trip	Self-responsibility	H4a.a	0.124**	0.000	Supported
	Support on MST	H4a.b	0.178**	0.000	Supported
During trip					
	Self-responsibility	H4b.a	0.130**	0.000	Supported
	Support on MST	H4b.b	0.173**	0.000	Supported
H5	**TM → TS**				
	Self-responsibility	H5a	0.121**	0.000	Supported
	Support on MST	H5b	0.155**	0.000	Supported
N = 864					

P = significant level; *r* = Pearson Correlation Coefficient; TI = Tourism Information; TM = Travel Mode; TS = Tourism Sustainability; TT = Tourist Typology.

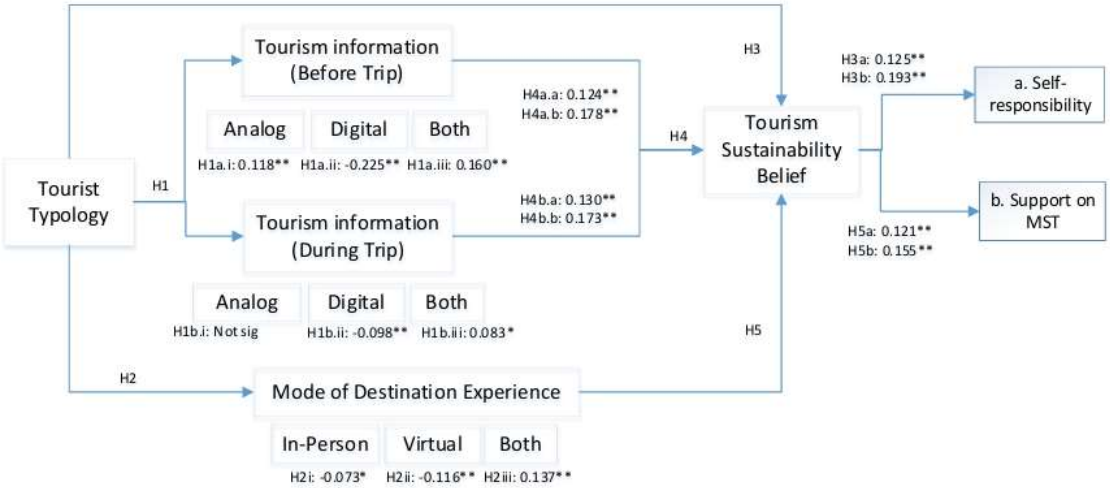

Figure 2. Correlations between the latent and observed variables.

4.5.1. Tourism information and destination experience (H1, H2)

Aside from the above, tourist typology significantly correlates with the preference for tourism information before and during the trip, supporting H1. For samples who prefer digital sources, the correlation is stronger before the trip ($r = -0.225$, $P < 0.01$) than during it ($r = -0.098$, $P < 0.01$). Similar for samples who prefer both analog and digital sources together, the correlation is stronger before than during the trip ($r = 0.160$ and 0.083 respectively, $P < 0.01$).

Tourist typology is also found to significantly correlate with the preference of travel mode, supporting H2, in ascending strength from samples who prefer in-person mode ($r = -0.073$, $P < 0.01$), virtual mode ($r = -0.116$, $P < 0.01$), to a mixture of both modes ($r = 0.137$, $P < 0.01$). Besides OMT (37.5%), around half of the other three types of tourists (47.3% to 48.5%) prefer to visit the destination in person (**Table 6**). Only a minimum of 9% to a maximum of 19% from each tourist type prefer to "visit" the destination through virtual tours. In addition, though organized mass tourists (OMT) least prefer virtual tours (8.8%), they are the type with the highest proportion that prefer a mixed travel mode of both in-person and virtual tours (53.7%). Following in line is the socializer tourists (S) on the preference for virtual tours (12.8%) and mixed travel modes (40.4%).

4.5.2. Tourism sustainability (H3 to H5)

Tourist typology is found to significantly correlate with tourism sustainability beliefs, supporting H3, with respect to both perceived self-responsibility ($r = 0.125$, $p < 0.01$) and the support on MST ($r = 0.193$, $p < .001$). In addition, the preference for tourism information sources and travel modes is found to significantly correlate with tourism sustainability, supporting H4 and H5 (**Table 5**). Over the 23 MST indicators, findings signify a very high supporting coverage, with OMT supporting an average of 21.7 indicators, followed by socializer 20.3, learners 20.25, and IMT supporting an average of 19.5 indicators. However, comparatively low and diverging findings on perceived self-responsibility for tourism sustainability are found. OMT expressed the highest perceived self-responsibility ($M = 4.07$), learners ($M = 3.85$) as subsequent, then socializers ($M = 3.82$) and IMT ($M = 3.69$) denoted the lowest self-responsibility on tourism sustainability (**Table 6**).

Table 6. Preference and descriptive statistics of the four clusters under tourist typology.

TT	PS-tourism sustainability	S-MST	TM			RTI						ItoT
						BT			DT			
			IP	*V*	*B*	Ana	*D*	*B*	Ana	*D*	*B*	
IMT	3.69	19.50	47.3%	18.6%	34.2%	5.3%	50.8%	43.8%	13.2%	34.7%	52.1%	4.03
S	3.82	20.30	46.8%	12.8%	40.4%	5.5%	43.5%	51.0%	9.5%	31.0%	59.6%	4.32
L	3.85	20.25	48.5%	14.6%	37.0%	7.0%	38.2%	54.8%	13.7%	30.1%	56.2%	4.12
OMT	4.07	21.70	37.5%	8.8%	53.7%	12.0%	25.0%	63.0%	12.1%	23.0%	64.9%	4.35

Ana = Analog; *B* = Both; BT = Before Trip; *D* = Digital; DT = During Trip; IMT = Individual Mass Tourist; IP = In Person; ItoT = Interest to Travel; L = Learner; OMT = Organized Mass Tourist; PS-tourism sustainability = Perceived Self-Responsibility on Tourism Sustainability; RTI = Receive Tourism Information; S = Socializer; S-MST = Support on MST Indicators; TM = Travel Mode; TT = Tourist Typology; *V* = Virtual.

Based on the findings, the following new classification of tourist typology regarding tourism sustainability is deduced, with respect to tourism information and travel mode preferences (**Table 7**).

Table 7. New tourist typology with the incorporation of tourism sustainability and preference of information.

TT		PS-tourism sustainability	Tourism information				TM
			BT		DT		
			Ana vs. *D*	*B*	Ana vs. *D*	*B*	IP vs. *V*
IMT	Prefer destination with familiar culture, touristic facilities, transportation systems, being well-developed, popular and environmentally friendly	Low	Strong D	Low B	Moderate D	Moderate B	In-person
S	Like to associate with locals and live like the locals, seek excitement and novelty	Moderate	Strong D	Low B	Strong D	Strong B	In-person
L	Prefer to actively participate in activities that provide new experiences and challenges	Moderate	Moderate D	Moderate B	Moderate D	Strong B	In-person
OMT	Prefer to join guide tours, be cared for by travel agencies, and live in international hotel chains	High	Low D	Strong B	Low D	Strong B	In-person + virtual

Ana = Analog; *B* = Both; BT = Before Trip; *D* = Digital; DT = During Trip; IMT = Individual Mass Tourist; IP = In Person; L = Learner; OMT = Organized Mass Tourist; PS-tourism sustainability = Perceived Self-Responsibility on Tourism Sustainability; S = Socializer; TM = Travel Mode; TT = Tourist Typology; *V* = Virtual. *N* = 864.

5. Discussion

The pandemic not only brought challenges but also opportunities to allow the stakeholders to ruminate over the topic of tourism. From a kind of activity that is termed as growing luxury and nice to have, tourism is found to become part of the life routine that needs to take place from time to time. As shown in **Table 6**, all types of tourists have signified high interest in traveling, especially for OMT ($M = 4.35$) when compared to the least interest IMT ($M = 4.03$). Socializers also show a high interest in traveling ($M = 4.32$), similar to OMT, and learners have a slightly lower interest ($M = 4.12$). This has provided valuable indications that tourism will grow at an astonishing speed, though this also implies that the need to exercise sustainable tourism practices becomes increasingly critical.

UNWTO started the MST Programme in 2016 and announced the 23 MST indicators in 2017[43]. Current research shows that tourists highly support the majority of MST indicators and this denotes promising bases for sustainable tourism activities and practices. However, the moderate to low scores on perceived self-responsibility for IMT, socializers, and learners imply that even though the tourists support sustainable tourism measures, they do not perceive they are held responsible for making it a success. This resonates with the findings of Ballantyne et al.[47] that the general public is not as interested as wildlife tourists in conservation issues. Inadequate education and in-depth understanding may be among the reasons leading to such discrepancies in belief and perception.

Based on the knowledge gap theory, discrepancies in the communication and processing of information will affect the quality of information acquired and retained[1]. Amongst the four types of tourists, OMT holds the highest perceived self-responsibility on tourism sustainability ($M = 4.07$). They have the smallest differences in the preference of travel information before (13%) and during (10.9%) the trip. On the contrary, IMT possesses the lowest perceived self-responsibility ($M = 3.69$), and important to note is that they have the greatest differences in the preference of travel information before (45.5%) and during (21.5%) the trip. Therefore, if sustainable tourism information is disseminated without considering the preferences of tourists, the objectives of the information may not be well communicated. This may seriously affect the understanding of the need for self-responsibility to bring tourism sustainability to the destination.

Digital platforms and social media contain substantial information that can be obtained at obvious

convenience. Applying the knowledge gap theory, tourists who are more inclined to receive digital information are in positions where they have access to more information. However, the consistency, quality, and depth of the contents vary. Moreover, access to a wide range of information may imply an overloading of information, when the interpretation of the information received will be affected by cognitive capacity, motivation, and prior knowledge[6]. The relative significance of digital information will then decline when information becomes too abundant, and this resonates with the findings of Cheema and Papatla[48]. This may explain the situation of IMT. They are aware of the need for tourism sustainability leading to their high support for the MST indicators (M = 19.5). However, they may not be well-informed by the mass information on the responsibility of stakeholders. Therefore, they have not interpreted the information effectively that can enhance their ability to develop a sense of self-responsibility in tourism sustainability. This situation is similar to the findings of Le Heron and Sligo[49] that the understanding and retention of complex knowledge is affected by the prior knowledge of the learner.

In addition, there is no guarantee that the digital information is all true and fair. Abundant research has found digital information to be deceptive and detrimental[50–53]. Alike the current study, IMT relies more on digital resources for information and guidance and may receive biased information, resulting in the knowledge gap between the need to support tourism sustainability versus being held responsible for maintaining tourism sustainability. As for the OMTs, who are prone to access information through analog and digital sources are more likely to receive comprehensive information. This deduction is further supported when we examine the socializers. Socializers are tourists who like to associate with locals and live like the locals, seeking excitement and novelty. Findings show that they prefer to visit the destination in person (46.8%) far more than through virtual tours (12.8%). They expressed similar support to tourism sustainable MST indicators (M = 20.3) but only possess moderate perceived self-responsibility to the sustainability of tourism. Even though they prefer to associate with locals, they also strongly prefer receiving digital information. Compared to OMT, their preference for receiving both digital and analog information is lower. This shows the importance of analog information in delivering comprehensive information on tourism sustainability.

5.1. Theoretical contributions

First, the current study has expanded the literature on tourist typology (**Table 7**). Adding on to tourism attributes, tourists were classified according to three more attributes (1) perceived self-responsibility on tourism sustainability; (2) preference for digital or analog tourism information; and (3) preference for travel modes. Four types of tourists were identified, namely individual mass tourists (IMT), socializers (S), learners (L), and organized mass tourists (OMT). IMT are tourists who prefer well-developed destinations with familiar facilities and culture and tend to receive digital information but have a low perceived self-responsibility on tourism sustainability. Socializers like to associate with the locals and seek novelty but prefer to receive digital information, and possess moderate self-responsibility on tourism sustainability. Learners prefer to participate in new experiences and challenges, intend to receive both digital and analog information, and possess moderate self-responsibility on tourism sustainability.

Second, the findings demonstrate a significant correlation between a preference for tourism information and tourism sustainability beliefs. The higher the preference for receiving both analog and digital office information, the higher the perceived self-responsibility on tourism sustainability.

5.2. Managerial contributions

Third, from the findings on the strong support of the MST indicators, it is obvious that the joint efforts of governments and the United Nations on the education of the need for tourism sustainability have achieved obvious results. Tourists across the spectrum of typology with varying demographics and backgrounds know

the importance of tourism sustainability. However, the results on the low to moderate perceived self-responsibility on tourism sustainability signifies that the majority of tourists are aware only of the concepts but not the actions required. The involvement of the various stakeholders needs to be explicitly explained, and the particular actions of the stakeholders should be more precisely described.

Fourth, the use of digital platforms and media to educate tourism sustainability can reach a wider audience, and the early steps to arouse the attention of the public have been achieved. Based on the high perceived self-responsibility of OMT, it is necessary to implement more strategic education and marketing plans, through the usage of both analog and digital information. Governments should allocate efforts to promote tourism sustainability at local destinations to supplement the digital information available from the Internet. They can apply tools to link up the two types of information, like using role models. With a mascot as an example, they can always yield good attractions from tourists. The analog mascots that tourists see at the destination will remind them of the sustainable practices they have seen from the mascot online before the trip. With limited resources and to avoid overloading the tourists with information, we should focus on integrating educational content into the digital marketing materials of the destination before the tourists arrive at the destination. The educational content should illustrate the destructive effects of inappropriate actions of the tourists at the destination as negative reinforcement and showcase sustainable practices by a role model whom the tourists can imitate and learn from. Then, the role model extends the knowledge delivered to the tourists during the trip in the physical setting.

6. Conclusion

Stakeholders are reconsidering the importance of sustainability in tourism due to economic and technical progress. The MST Programme of UNWTO and its indicators have offered a robust framework for implementing these practices. Nevertheless, this research reveals a disparity between the widespread endorsement of MST policies and the perception of tourist on their individual accountability for their efficacy.

This study employs the knowledge gap theory to analyze the preferences of travelers for digital and analog tourism information, as well as their obligations toward sustainable tourism. While digital tourists acknowledge the need for sustainability, they do not perceive themselves as individually accountable for actively advocating it. However, tourists who utilize both kinds of information demonstrate greater accountability. Although tourists may know about sustainability, they may not feel obligated to take action because of the quality and cognitive integration of the information provided.

This study enhances our comprehension of tourist typology in the context of sustainability by classifying tourists based on their information preferences and modes of travel. This study underscores the necessity for continuous and sustainable tourist promotion, while the findings also highlight the importance of going beyond mere promotion to actively educate tourists about actual actions they may do and their pivotal role in achieving sustainable objectives.

This research illustrates that while many tourists express a preference for sustainability in principle, they do not feel compelled to implement it. This lack of accountability underscores the necessity for targeted information and educational initiatives that inform and motivate tourists to take action. Gaining insight into and fulfilling the needs and desires of various types of tourists can assist stakeholders in advancing sustainability within the tourism industry. This enhances the tourism industry and contributes to the attainment of environmental, social, and economic sustainability.

Future studies should assess the caliber and impact of both digital and analog information on tourist perceptions and behaviors. To comprehend the impact of disinformation or insufficient information on the

sustainable activities and perspectives of tourists, additional investigation is needed to assess the authenticity, reliability, and comprehensiveness of tourism information sources. An investigation of the potential benefits of utilizing various narrative styles, visual aids, and interactive experiences to enhance the delivery and reception of sustainability information could enhance educational outcomes and address gaps in knowledge.

Author contributions

Conceptualization, CCCL, YZ and ESKL; methodology, CCCL and YZ; software CCCL and YZ; validation, CCCL, YZ and ESKL; formal analysis, CCCL and YZ; investigation, CCCL, YZ and ESKL; resources, CCCL, YZ and ESKL; data curation, CCCL, YZ and ESKL; writing—original draft preparation, CCCL; writing—review and editing, CCCL and ESKL; visualization, CCCL and ESKL; supervision, CCCL; project administration, ESKL; funding acquisition, ESKL. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

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