

Original Paper

Tourist Engagement and Perceived Naturalness: Unveiling the Pathways to Sustainable Tourism and Purchase Intentions in Vertical Farming

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Received: February 02, 2024

Accepted: March 20, 2024

Online Published: April 03, 2024

doi:10.22158/ibes.v6n2p124

URL: <http://dx.doi.org/10.22158/ibes.v6n2p124>

Abstract

With sustainable tourism and escalating food demands, vertical farming emerges as a pivotal innovation that bridges agricultural sustainability and tourism. This paper explores the role of tourist engagement at vertical farms in promoting sustainability awareness, altering perceptions of naturalness of vertical farm agricultural products, and shaping purchase intentions for these products. Utilizing Consumer Socialization Theory (CST) as a framework, the study delves into how tourist engagement at vertical farms can serve as a catalyst for enhancing the appeal and acceptance of sustainable agricultural practices. A cross sectional survey of 558 tourists in Malaysia and the Greater Bay Area of China was conducted using a quantitative approach. A Structural Equation Model (SEM) analysis revealed that tourist engagement significantly increases sustainability awareness and perceived naturalness, which, in turn, positively impacts purchase intentions. Interestingly, while tourist engagement directly increases purchase intentions, sustainability awareness does not directly increase purchase intentions, underscoring the nuanced role perceived naturalness plays in the decision making process. The findings underscore the importance of integrating vertical farming into the tourism experience as a strategy for promoting sustainable agricultural practices and increasing consumer acceptance. This study enriches the discourse on sustainable tourism's role in advancing sustainable agriculture, providing key insights for stakeholders in both the tourism and agriculture sectors to foster environmental stewardship and sustainable consumer behavior.

Keywords

Agritourism, vertical farm produce, sustainable tourism, consumer behavior, tourist engagement, sustainability awareness, perceived naturalness, purchase intention, environmental education

1. Introduction

The relentless pace of global population growth and the consequent decrease in available arable land have placed a significant strain on traditional agricultural practices (Döös, 2002; United Nations, Department of Economic and Social Affairs, 2017), resulting in an urgent need for innovative solutions such as vertical farming. With the advent of this new agricultural technique, which cultivates crops within controlled environments in vertically stacked layers or integrated structures, it provides a sustainable alternative that addresses environmental challenges as well as global food security and hunger issues (Kobayashi et al., 2022; Despommier & Ellingsen, 2008; Al-Kodmany, 2018; Avgoustaki & Xydis, 2020). A comprehensive approach to sustainable agriculture can be achieved through vertical farming since it reduces water usage, minimizes land use, reduces deforestation, and decreases the use of pesticides and herbicides (Despommier & Ellingsen, 2008; De Oliveira 2021). Besides its ability to enable year-round production, it also reduces transportation costs and reduces carbon footprint, making it an increasingly valuable solution to sustainability issues facing the global food supply chain (Despommier, 2008; Oh & Lu, 2023).

The scale and growth trend of vertical farming have been remarkable, with the industry experiencing rapid expansion as it responds to the escalating demands of urbanization and sustainable food production (Al-Kodmany, 2018; Avgoustaki & Xydis, 2020). In addition to attracting investors and environmentalists, this burgeoning sector has also developed into an attractive tourist destination. Countries like Malaysia and China are at the forefront of integrating vertical farming into their tourism offerings (Islam & Siwar 2012; Glaros et al., 2022), allowing visitors to explore these futuristic farms and learn about the technologies driving sustainable agriculture. The evolution of vertical farms into tourist attractions reflects an increasing interest in sustainable practices and a desire among consumers and travelers to connect with the source of their food more deeply.

As vertical farming becomes an integral part of the tourism industry, it presents an unprecedented opportunity to educate and engage the public regarding the importance of sustainable agricultural practices. Visitors to these farms can experience immersive experiences that can enhance their understanding of sustainability, thereby reshaping perceptions and cultivating a greater appreciation for the innovation behind vertical farming (Fusté-Forné & Forné, 2021). This nexus between agriculture and tourism not only highlights the versatility of vertical farming but also positions it as a key player in the journey towards sustainable development, offering a glimpse into the future of food production in a world where resources are increasingly scarce.

In spite of the environmental advantages of vertical farming, consumer acceptance has been tepid, largely due to perceptions of its unnaturalness and a lack of awareness of its sustainability advantages. The concept of sustainability awareness is crucial in this context, as it represents the consumers' understanding and appreciation of practices that promote environmental conservation and long-term ecological balance. However, there appears to be a gap in sustainability awareness among consumers concerning vertical farming, hindering its acceptance and the broader adoption of its produce.

Compounding this issue is the perception among many that produce from vertical farms is unnatural (Son & Hwang, 2023; Etale & Siegrist, 2021; Abouab & Gomez, 2015). This belief stems from misconceptions about the technologically advanced methods used in vertical farming, which diverge from traditional farming techniques (Jürkenbeck et al., 2019). The controlled, indoor environments and the use of artificial lighting and hydroponics in vertical farming are often mistakenly equated with a lack of naturalness, deterring some consumers from embracing vertical farm produce (Coyle & Ellison, 2017; Son & Hwang, 2023). This perception challenges the purchase intention of the vertical farm produce, underscoring the need to demystify these innovative techniques and highlight their alignment with natural and sustainable principles.

Taking into account these challenges, tourist engagement can be used as a powerful tool to enhance both the perception of naturalness of vertical farm products and sustainability awareness. Engaging tourists in immersive experiences at vertical farms not only demystifies the technology behind the method but also enhances the perception of naturalness of the produce by directly connecting consumers with the production process. Such engagement opportunities provide an experiential learning platform, bridging the knowledge gap and reshaping perceptions towards a more positive outlook on vertical farming.

This study addresses several gaps and contributions within the existing literature on this subject. Firstly, there is a noticeable silence regarding the effect of tourist engagement on the perceived naturalness of vertical farm produce. Secondly, research on the relationship between perceived naturalness and the purchase intention of vertical farm produce is significantly limited (Son & Hwang, 2023; Jürkenbeck et al., 2019). Moreover, there is a call for more extensive research into both engagement and sustainability awareness (Rather et al., 2019; Jürkenbeck et al., 2019), indicating a gap in the literature that this study aims to fill. Despite progress in understanding sustainability awareness, this area of research requires further exploration to deepen our understanding of its impacts (Kumar et al., 2017). Furthermore, research on perceived naturalness, particularly concerning food, has faced criticism for its lack of consensus on definitions and measurement scales (von Meyer-Höfer et al., 2015; Hemmerling et al., 2016), with most studies confined to the food science discipline rather than the realms of tourism and marketing (Etale et al., 2021; Román et al., 2017; Sinesio et al., 2018). Lastly, no research has been identified that explores the linkage of tourist engagement with sustainability awareness and perceived naturalness of food within the context of tourism and marketing. This study aims to bridge these gaps by providing insights into how engaging tourism experiences at vertical farms can influence consumer perceptions of its produce, thereby promoting sustainability awareness and enhancing the purchase intention of vertical farm produce.

2. Literature Review and Hypothesis Development

2.1 Consumer Socialization Theory

Consumer Socialization Theory (CST) provides a foundational perspective for investigating how

individuals become acquainted with consumer roles and behaviors within specific contexts, including sustainable tourism practices like those encountered in vertical farming (Ward, 1974). CST posits that through interactions with various agents of socialization—such as family, peers, media, and direct experiences—individuals learn the norms, values, and behaviors associated with being a consumer in different contexts (John, 1999). This theoretical lens is especially relevant for exploring the nexus between tourists' engagement in vertical farms, their sustainability awareness, perceived naturalness of the environment, and subsequent purchase intentions.

In the context of this study, engagement at vertical farms represents a critical avenue through which tourists undergo socialization towards sustainability. As tourists interact with the environment, partake in educational tours, and engage with narratives of sustainable practices, they are not merely passive recipients of information but active learners. This experiential learning process is central to CST and underscores how direct engagement can elevate tourists' awareness of sustainability issues, echoing the sentiments of Moscardo (1996) regarding the educative potential of tourism experiences. Additionally, the concept of perceived naturalness can be examined through the CST framework, considering how tourists' interactions within the farm setting contribute to their understanding and valuation of natural products. The appreciation for naturalness, cultivated through educational components and firsthand experiences of sustainable practices, signifies another aspect of the socialization process, guiding tourists toward preferences and purchase intentions that reflect an environmental consciousness.

In sum, Consumer socialization theory offers a compelling framework for dissecting the ways in which engagement in vertical farm tourism acts as a mechanism for socializing tourists into sustainable consumption patterns. By focusing on the experiential and informational exchanges that occur within these settings, the study leverages CST to provide deeper insights into how tourists' sustainability awareness, perceptions of naturalness, and purchase intentions are shaped and influenced.

2.2 Tourist Engagement

The concept of engagement has been extensively explored across various disciplines, including marketing, tourism and hospitality, psychology, and sociology, recognized as a precursor to behavior (Bowden, 2009; Brodie et al., 2011; Van Doorn et al., 2010). Despite the widespread attention, a unified definition remains elusive (Rather et al., 2019), highlighting an opportunity for further exploration into its applicability across diverse research contexts. Efforts to delineate engagement have been noted across disciplines. For example, in tourism research, engagement is often perceived as a psychological state arising from interactive experiences with destinations or activities (Higgins & Scholer, 2009; Hollebeek, 2011; Patterson, Yu, & De Ruyter, 2006; So et al., 2014). Vivek, Beatty, and Morgan (2012) describe engagement as the intensity of an individual's participation and connection with a company's offerings, which can be initiated by either the company or the customer.

In the field of marketing, engagement has been positioned as a complement to satisfaction, addressing its limitations in predicting loyalty (Appelbaum, 2001; McEwen & Fleming, 2003). Its significance in fostering emotional connections between companies and customers has been underscored, along with

its role in influencing customer perceptions, purchase intentions, and loyalty (Mohr & Webb, 2005). Engagement is generally viewed through two lenses: psychological and behavioral (Venkatesan, 2017). Neither perspective alone sufficiently captures the essence of engagement, leading researchers to integrate both the psychological connection and behavioral participation of customers with a company (Brodie et al., 2011; Hollebeek, 2011; So et al., 2016). For this study, engagement is conceptualized following Brodie et al. (2011) as a multidimensional construct that reflects a context- and/or stakeholder-specific manifestation of relevant cognitive, emotional, and behavioral dimensions.

Measurements of engagement have predominantly been developed outside the tourism sector, with little focus on unique destinations such as vertical farms. The existing literature reveals a gap in understanding tourists' behaviors, emotions, and experiences within specific destinations, leading to a scarcity of precise measurement scales addressing engagement in tourism research (Rather et al., 2019). This study ventures into relatively uncharted territory by adapting "customer" engagement metrics for "tourist" engagement in the novel context of vertical farms as tourism destinations. By carefully selecting, combining, and modifying existing engagement scales from various disciplines, this research aims to deductively test and refine these metrics to bridge the identified research gap.

Engagement in the context of tourism, especially within vertical farm settings, is inherently reciprocal, involving interactions between tourists and service providers. Unlike traditional marketing's emphasis on unilateral company-to-customer interactions, current trends highlight the importance of bidirectional engagement, where customers actively participate in value creation (McAlexander, Schouten, & Koenig, 2002). Huang et al. (2019) emphasize that engagement at tourism destinations manifests through immediate, face-to-face interactions—both social and physical—between tourists and other actors. Activities such as picking fruits and vegetables or operating agricultural equipment facilitate interactive experiences and co-creation at vertical farm tourist destinations.

Michel, Brown, and Gallan (2008) further argue that value co-creation transcends mere transactions, allowing customers to contribute to product innovation through their knowledge and experiences. Tourists act as operant resources, bringing unique skills, knowledge, and expertise to the destination (Baron & Harris, 2008). Their engagement, such as sharing experiences on social media or providing feedback, further extend the interaction into the virtual realm, potentially raising awareness about sustainability among tourists. This co-creative process of engagement, intrinsic to the study's context, offers a platform for tourists to actively participate, potentially heightening sustainability awareness and influencing behavioral intentions. By integrating and exchanging resources in a collaborative manner, all actors within the service system contribute to value co-creation (Jaakkola & Alexander, 2014). Assessing engagement in vertical farms as tourist destinations, therefore, holds practical significance for destination management organizations, underpinning the theoretical and applied dimensions of this research in promoting sustainability and active tourist participation.

Research has underscored the pivotal role of engagement in facilitating students' tangible interaction with sustainability knowledge, often in collaborative environments (Cogut et al., 2019). To foster a

profound understanding of sustainability, individuals must first be introduced to new concepts and practices; without this initial awareness, altering long-term behaviors becomes challenging (Emanuel & Adams, 2011; Cotton et al., 2016). Therefore, educational initiatives, such as school-organized study tours to vertical farms, can be identified as impactful means of introducing young learners to sustainability issues. These hands-on activities, including learning about scientific advancements in environmental sustainability and the value of aquaculture products, enhance understanding of sustainable practices and their benefits to both consumers and end-users (Correia et al., 2020). Building on this understanding, the study proposes the following hypothesis:

Hypothesis 1: There is a positive relationship between tourist engagement and sustainability awareness.

This hypothesis suggests that tourist visits to vertical farms can enhance sustainability awareness and introduce visitors to innovative practices, potentially influencing their behaviors. However, while knowledge is crucial for fostering a community's understanding of sustainability, awareness by itself may not suffice to alter behaviors significantly (Too & Bajracharya, 2015). Other factors could also be influential. This study considers tourist engagement as a precursor to sustainability awareness, aiming to explore its impact on subsequent behaviors, including purchase intentions. Drawing on evidence from previous research that demonstrates a direct positive link between customer engagement and purchase behaviors (Prentice et al., 2019; Gummerus et al., 2012; Prentice et al., 2018; Vivek et al., 2012), the study integrates the concept of purchase intention as a dependent variable alongside sustainability awareness, thus proposing a novel research framework. Given the justification and empirical support for the influence of engagement on memorable experiences and behavioral intentions (Prebensen & Foss, 2011), the following hypothesis is introduced:

Hypothesis 2: There is a positive relationship between tourist engagement and purchase intention.

Empirical studies have demonstrated that engagement can enhance sensory perception and influence perceptions of product naturalness. For instance, immersive multisensory experiences simulating relaxing countryside settings were shown to increase the perceived freshness of vegetable products (Sinesio et al., 2018). Research by Son and Hwang (2022) suggests that human touch can significantly affect the perceived naturalness of produce grown in vertical farms. This contrasts with the notion that industrial processing, often characterized by limited human interaction, may reduce perceived naturalness (Abouab & Gomez, 2015). Given the human-centric nature of engagement and interaction in vertical farm settings, the study posits the following hypothesis:

Hypothesis 3: There is a positive relationship between tourist engagement and perceived naturalness.

Through these hypotheses, the study seeks to unravel the intricate relationships between tourist engagement, sustainability awareness, purchase intentions, and perceived naturalness, contributing to a nuanced understanding of engagement's role in promoting sustainable practices.

2.3 Sustainability Awareness

The trend of increasing consumer consciousness towards ecological issues reflects a growing

awareness of the detrimental impacts of environmental degradation, driven by economic development and the depletion of natural resources. This shift in consumer consciousness emphasizes the priority for more sustainable consumer products, as evidenced by research highlighting the transition towards environmentally friendly options (Li et al., 2020). The demand for sustainable agricultural practices, exemplified by vertical farming, arises from global environmental degradation (Al-Kodmany, 2018; Avgoustaki & Xydis, 2020). Vertical farming, with its potential for no-cost ecosystem restoration, embodies such sustainable products (Despommier & Ellingsen, 2008). A deeper understanding of environmental issues and the recognition of environmental fragility can lead to more pro-environmental behaviors (Darvishmotevali & Altinay, 2022), underlining the importance of integrating sustainability awareness into the assessment of green products like vertical farm produce.

Moreover, while raising sustainability awareness is often considered a preliminary step towards enhancing sustainable behaviors, the direct impact of such awareness on changing behaviors remains less understood (Jucker, 2002; Boyes et al., 2009; Kollmuss & Agyeman, 2002). This gap underscores the need for further research to explore the effects of increased sustainability awareness on behavioral shifts. Although awareness is critical, it may not always translate into sustainable behavior (Boyes et al., 2009). Kumar et al. (2017) have pointed out the potential of purchase intentions for environmentally sustainable products, advocating for further validation across different countries and industries. Additionally, the synergy of sustainability awareness with other variables is suggested to influence subsequent behavioral changes (Sogari et al., 2019; Henault-Ethier et al., 2020; Panda et al., 2020; Garanti, 2020).

This study proposes a novel framework that combines sustainability awareness with perceived naturalness and tourist engagement to elucidate tourists' purchase intentions for vertical farm produce in an Asian context. Previous research has sought to validate the link between sustainability awareness and purchase intention across various industries. For example, studies within the context of insect-based food consumption have identified sustainability as a key motivational factor (Legendre et al., 2019; Palmieri et al., 2019). In the sustainable clothing sector, sustainability awareness has been recognized as a strong predictor of purchasing behavior (Kleinhückelkotten & Neitzke, 2019). Additionally, consumers informed about environmental sustainability issues are less likely to buy products that harm the environment (Aruga, 2020; Ahmed et al., 2021). High levels of sustainability awareness among consumers correlate with a stronger intention to purchase sustainable or green products, fostering pro-environmental intentions and behaviors (Li et al., 2020; Jaiswal & Kant, 2018; Jauhari, 2017). While previous studies indicate a positive relationship between sustainability awareness and consumer responses (Alevizou et al., 2018), a consensus on this relationship has yet to be achieved. Contrarily, Wendin and Nyberg (2021) argued that strong sustainability awareness might not significantly predict consumption willingness, suggesting the need for hypothesized relationships to be proposed and validated within the research context. Based on the literature review, the following hypothesis is proposed:

Hypothesis 4: Sustainability awareness has a positive relationship with purchase intention.

2.4 Perceived Naturalness

The inherent human attraction to natural elements (Wilson, 1984) aligns with findings from the Nielsen Global Health and Wellness Survey (2015), which highlighted naturalness as a highly valued attribute in food by consumers. This preference is supported by a body of research indicating a favorable consumer attitude towards natural products over their unnatural counterparts (Gifford & Bernard, 2011; Rozin et al., 2004; Rozin, 2006). Murdoch and Miele (1999) criticized industrial food systems for producing foods that lack natural qualities. Studies have shown that foods perceived as less natural often involve industrial processing or modern production methods (Fibri & Frøst, 2019; Caputo et al., 2020; Etale & Siegrist, 2018). Conversely, foods produced through traditional methods are generally rated higher in terms of perceived naturalness (Iaccarino et al., 2006; Vecchio et al., 2019; Caporale & Monteleone, 2004), with small-scale productions being favored for their naturalness (Scekic & Krishna, 2021; Abouab & Gomez, 2015; Cirne et al., 2019). These perspectives may challenge the perception of vertical farm produce's naturalness, potentially overshadowing the environmental, economic, and social benefits associated with vertical farming. Rozin et al. (2012) observed a strong consumer preference for natural foods, emphasizing the importance of exploring the impact of engagement on perceived naturalness and its influence on purchase intentions to enhance the acceptability and sales of vertical farm produce.

The concept of naturalness, however, is abstract and lacks a consensus on its measurement due to ambiguous definitions and regulations (Siipi, 2013; Román et al., 2017; von Meyer-Höfer et al., 2015). Hemmerling et al. (2016) described the concept of food naturalness as vague, unclear, and potentially misleading for consumers. Consumers' judgments on naturalness vary, influenced by factors such as healthiness, environmental friendliness, organic production, local production, absence of genetic modification, and perceived taste and nutrition (Hasselbach & Roosen, 2015; Strohbach & Schupp, 2012; Gorton & Barjolle, 2012; Siipi, 2013). This study aims to contribute by deductively verifying the concept of naturalness, integrating various measurement scales that encompass these concerns and assessing the concept of perceived naturalness within the context of vertical farming.

Given the ambiguous definition of natural food, vegetables, including those produced in vertical farms, are often considered natural in various contexts (Rozin et al., 2012). Nonetheless, the degree of perceived naturalness and its impact on consumer behavior warrant further exploration. Some studies have identified a positive influence of food naturalness on the consumption of healthy foods across different countries (Grubor et al., 2015; Pollard et al., 1998, 2002; Steptoe & Wardle, 1999; Thong & Solgaard, 2017). However, Lähteenmäki et al. (2002) noted a potential negative correlation between the importance of food naturalness and purchase intentions for genetically modified cheese in Northern European contexts, highlighting the need for research in diverse settings, including vertical farming products in Asian countries. Based on the literature, the following hypothesis is proposed:

Hypothesis 5: Perceived naturalness has a positive relationship with purchase intention.

Aforementioned hypotheses contribute to the research framework of the study, illustrated in Figure 1, which maps the assumed relationships between variables and reflects the proposed research hypotheses.

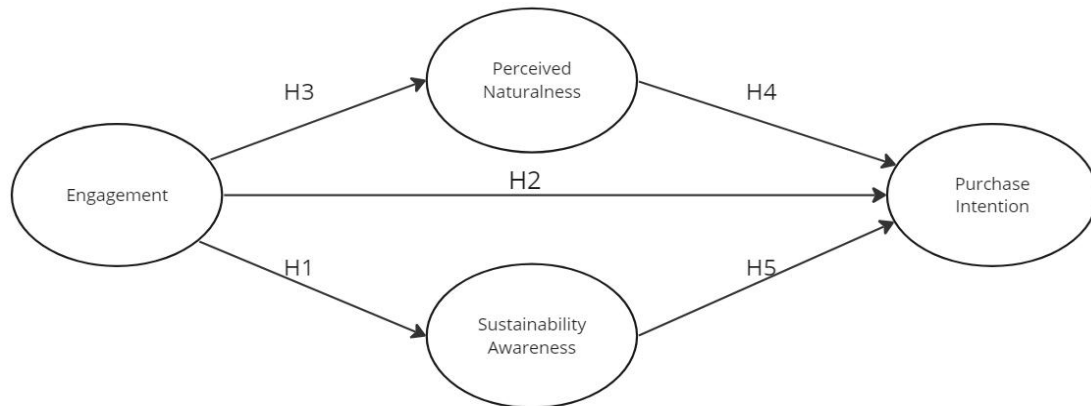


Figure 1. Research Framework

3. Methods

3.1 Sampling and Data Collection

This study employed a descriptive cross-sectional survey design with a quantitative approach, conducted in specific locations in Malaysia (Cameron Highlands, Kuala Lumpur, Genting Highlands) and the Greater Bay Area of China, known for their concentration of vertical farms open to tourists. The international scope of the study aimed to enhance diversity and reduce potential cultural bias in the sample.

Participants were approached at the exits of the farms to ensure they had firsthand experience with vertical farm tours. The survey incorporated filter questions to verify participants' experience with such tours. Data collection occurred offline from September 2023 to January 2024, yielding 593 completed questionnaires through non-probability convenience sampling. After removing incomplete or outlier responses, 558 participants (94.1% response rate) were included in the final analysis, aligning with the sufficiency criteria suggested by Hair et al. (2014). The sample comprised 257 Malaysian (46.1%) and 301 Chinese participants (53.9%).

To ensure linguistic accuracy and the effectiveness of the questionnaire translation, this study adopted the back-translation method, a process recommended by Brislin (1970) for cross-cultural research to ensure semantic and conceptual equivalence between languages. The questionnaire items were initially translated from English to Chinese and Malay, and then revised in line with the scale development process outlined by Churchill (1979), which emphasizes the importance of validity and reliability in measurement instruments. Subsequently, two experienced Malaysian trilingual researchers in linguistics and literature were invited to translate the questionnaire items back to English, following Brislin's back-translation method. To confirm the validity of the translated questionnaire, pre-tests were

conducted with selected scholars from Chinese and Malaysian universities, evaluating the questionnaire for clarity and comprehension. Following this, a pilot study involving 87 tourists at a vertical farm in Guangzhou, China, was conducted. The reliability analysis from this pilot study indicated that the Cronbach's α values for all variables exceeded the acceptable threshold of 0.7, demonstrating the robustness of the questionnaire's translation and its suitability for formal administration across different linguistic and cultural contexts.

3.2 Measurement Scales

The study adapted measurement items from prior research, utilizing multiple items for each scale. Engagement was assessed with a 5-item scale from Vivek et al. (2014) and Huang and Choi (2019). Perceived naturalness was measured using a modified 6-item scale based on Backström et al. (2004), Renner et al. (2012), and Hemmerling et al. (2016). Sustainability awareness was evaluated with a 6-item scale adapted from Zhu et al. (2008), Laosirihongthong et al. (2013), Paulraj (2011), and Nguyen et al. (2023). Purchase intention was measured using four items from Baker and Churchill (1977). All constructs were assessed on a seven-point Likert scale, totaling 21 items. The survey's validity and reliability were confirmed through pilot testing and factor analysis.

3.3 Model Testing

For model testing, this research followed the guidelines provided by Hair et al. (2011) and chose Structural Equation Modeling (SEM) with the Partial Least Squares (PLS) approach as the most fitting method for evaluating the proposed hypotheses. This decision was based on the method's appropriateness for complex model assessments involving multiple constructs. With a substantial sample size of 558 valid responses, our study significantly exceeds the minimum sample size recommendations for SEM, thereby ensuring a strong statistical foundation for the analysis. The analysis was conducted using SmartPLS 4.0 software (SmartPLS GmbH, Hamburg, Germany), a tool chosen for its efficiency in handling PLS-SEM analyses. Additionally, preliminary analyses, including descriptive statistics and tests for multicollinearity, were carried out using IBM SPSS Statistics, Version 26 (IBM Corp, Armonk, NY, USA). This comprehensive approach to data analysis allowed for a thorough investigation of the relationships between the study's variables, contributing valuable insights into consumer intentions towards purchasing produce from vertical farms and enhancing the understanding of this emergent area of research.

3.4 Description of the Sample

The study engaged a diverse group of 558 tourists, demonstrating a varied demographic landscape within the context of vertical farm tourism (Table 1). The gender distribution of the participants shows a majority of males at 57.5%, followed by females at 41.8%, and a small yet inclusive representation of individuals identifying as 'Other' at 0.7%. This gender breakdown reflects a broad interest in vertical farming, indicating its appeal across different gender identities and suggesting a wide-ranging demographic interest in sustainable tourism practices.

The sample predominantly consists of younger tourists, with significant numbers in the 18–25 and

26-35 age brackets. This age distribution underscores the appeal of innovative tourism experiences, such as vertical farms, among younger demographics, who are potentially more attuned to sustainability issues and the benefits of engaging with eco-friendly tourism options. The respondents hail from a mix of countries, with a notable concentration from Malaysia and China, where vertical farming as a tourist attraction is gaining traction (Glaros et al., 2022). This geographical diversity, coupled with varied educational backgrounds, employment statuses, and income levels, provides a comprehensive insight into the attitudes and behaviors of tourists toward vertical farming. This diversity ensures the findings are reflective of a wide spectrum of consumer perspectives, enhancing the applicability and relevance of the study's conclusions to real-world settings.

Table 1. Demographic Details of Respondents (n = 558).

Socio-Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	321	57.5
	Female	233	41.8
	Other	4	0.7
Age	18–25	203	36.4
	26-35	189	33.9
	36-45	93	16.7
	46-65	52	9.3
	Over 65	21	3.8
Monthly Income in USD	500 and Below	78	14.0
	501-1000	130	23.3
	1001-2000	156	28.0
	2001-3000	111	19.9
	Over 3000	83	14.9
Education Level	High School	44	7.9
	Associate Degree	151	27.1
	Bachelor Degree	274	49.1
	Graduate Degree	89	15.9
Employment Status	Full-Time	263	47.1
	Part-Time	62	11.1
	Unemployed	6	1.1
	Student	184	33.0
	Retired	29	5.2
	Prefer not to answer	14	2.5
Marital Status	Single	288	51.6

	Married	219	39.2
	Prefer not to answer	51	9.2
Country	Malaysia	257	46.1
	China	301	53.9

4. Results

4.1 Reliability and Validity Analysis

The constructs of Engagement, Sustainability Awareness, Perceived Naturalness, and Purchase Intention underwent a rigorous assessment to establish their reliability and validity as part of the measurement model. The item loadings, Cronbach's alpha, composite reliability (ρ_a and ρ_c), and the Average Variance Extracted (AVE) were analyzed and evaluated against established thresholds within the social sciences to ensure the robustness of the constructs (Hair, Black, Babin, & Anderson, 2010) (Table2).

For the construct of Engagement, encompassing five items with loadings ranging from 0.701 to 0.757, reliability is evident with a Cronbach's alpha of 0.764, just above the acceptable threshold of 0.7 for social science research (Nunnally, 1978). Composite reliability, with ρ_a at 0.775 and ρ_c at 0.839, further corroborates the reliability of this construct. The AVE is at 0.511, slightly surpassing the cut-off point of 0.5, indicating a satisfactory level of convergent validity (Hair et al., 2010). The Sustainability Awareness construct demonstrated item loadings between 0.785 and 0.819, ensuring high item reliability. Cronbach's alpha for this construct was found to be 0.894, and the composite reliabilities stood at 0.896 (ρ_a) and 0.919 (ρ_c), both reflecting high internal consistency. The AVE was 0.653, well above the preferred 0.5 standard, confirming robust convergent validity. Perceived Naturalness, measured by six items with loadings from 0.802 to 0.846, showed an excellent Cronbach's alpha of 0.903. The composite reliabilities, ρ_a of 0.905 and ρ_c of 0.925, validate the internal consistency of this construct. The AVE for Perceived Naturalness reached 0.673, signifying strong convergent validity. The construct of Purchase Intention consisted of four items, showing loadings from 0.811 to 0.845. With a Cronbach's alpha of 0.847 and composite reliabilities of 0.854 (ρ_a) and 0.897 (ρ_c), the reliability of this construct is well established. An AVE of 0.685 indicates that Purchase Intention has excellent convergent validity, well above the recommended level.

The measurement model results are indicative of the constructs' high reliability and validity. The Cronbach's alpha and composite reliability values for each construct are comfortably above the standard minimums, suggesting that the constructs are reliable. Moreover, the AVE values for all constructs are above the 0.5 benchmark, ensuring that they possess a high degree of convergent validity and are appropriately measuring the phenomena they were intended to.

Table 2. Reliability and Construct Validity Values

Construct	No. of Item s	Item Loadin gs	Cronbac h's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Tourist		0.701-0.				
Engagement	5	757	0.764	0.775	0.839	0.511
Sustainabilit		0.785-0.				
y Awareness	6	819	0.894	0.896	0.919	0.653
Perceived		0.802-0.				
Naturalness	6	846	0.903	0.905	0.925	0.673
Purchase		0.811-0.				
Intention	4	845	0.847	0.854	0.897	0.685

4.2 Measurement Model: Fornell-Larcker Criterion and HTMT Analysis

In assessing discriminant validity within the measurement model, both the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio were employed. These assessments ensure that the constructs measured are distinctly separate and not overly similar in what they represent (Henseler, Ringle, & Sarstedt, 2015; Fornell & Larcker, 1981).

According to the Fornell-Larcker criterion, the square root of the Average Variance Extracted (AVE) for each construct should exceed the correlation between that construct and any other in the model, signifying that constructs share more variance with their indicators than with other constructs. The diagonal values in the table represent the square root of the AVE for each construct: Engagement (0.715), Sustainability Awareness (0.808), Perceived Naturalness (0.82), and Purchase Intention (0.828) (Table 3). These diagonal values are all higher than the off-diagonal values in their respective rows and columns, which represent the correlations with other constructs, thus satisfying the Fornell-Larcker criterion for discriminant validity.

The HTMT ratio is a relatively newer and more stringent criterion for assessing discriminant validity. The recommended threshold for HTMT values is below 0.85 (or 0.90 in more lenient cases), indicating sufficient discriminant validity between constructs (Henseler et al., 2015). In our study, all the HTMT values between different constructs are below this recommended threshold, further validating the discriminant validity of the constructs. For example, the HTMT value between Engagement and Perceived Naturalness is 0.151, which is below the recommended threshold, suggesting that these two constructs are indeed distinct.

These results, with all measures of discriminant validity meeting their respective recommended levels, suggest that the constructs within the model are adequately separated, thus validating the measurement

model used in this study. This confirmation of discriminant validity is crucial for subsequent structural model analysis as it assures that the relationships tested in the SEM are between distinct constructs and not confounded by measurement issues.

Table 3. Fornell-Larcker Criterion and HTMT Values

	Engagement	Sustainability Awareness	Perceived Naturalness	Purchase Intention
Tourist Engagement	0.715	0.316	0.151	0.048
Sustainability Awareness	0.368	0.808	0.424	0.173
Perceived Naturalness	0.529	0.381	0.82	0.357
Purchase Intention	0.183	0.151	0.317	0.828

Note. Bold values in brackets and diagonal represent square roots of AVE. Below the diagonal elements are the correlations between the construct's values. Above the diagonal elements are the HTMT values.

4.3 Structural Model Evaluation and Hypothesis Testing

The structural model evaluation and hypothesis testing were carried out to determine the strength and significance of the relationships between the constructs within the research model. The testing of hypotheses H1 through H5 was conducted using standardized coefficients and t-statistics, adhering to the standard significance level of $p < 0.05$ (Hair, Black, Babin, & Anderson, 2010) (Table 4).

The results indicated strong support for H1, H2, and H3, with Engagement serving as a significant predictor of Sustainability Awareness ($\beta = 0.468$, $t = 7.113$), Purchase Intention ($\beta = 0.353$, $t = 2.911$), and Perceived Naturalness ($\beta = 0.329$, $t = 4.458$), respectively. Each of these hypotheses was supported, demonstrating that higher levels of engagement are associated with increased awareness of sustainability, stronger purchase intentions, and a greater perception of naturalness among tourists.

Conversely, H4 was not supported, with the relationship between Sustainability Awareness and Purchase Intention ($\beta = 0.050$, $t = 1.165$) failing to reach statistical significance, suggesting that Sustainability Awareness does not have a direct influence on tourists' intention to purchase. However, H5 was supported, confirming that Perceived Naturalness positively affects Purchase Intention ($\beta = 0.305$, $t = 7.491$), which underscores the importance of naturalness in the decision-making process of consumers in the context of vertical farming tourism.

The structural model evaluation thus indicates that Engagement plays a significant role in predicting Sustainability Awareness, Perceived Naturalness, and Purchase Intention, while Sustainability Awareness does not significantly influence Purchase Intention. These findings offer critical insights into the drivers of Purchase Intention within the context of vertical farming tourism, highlighting the

importance of Engagement and Perceived Naturalness for tourists.

Table 4. Hypothesis Testing Outcomes

Hypothesis	Relationship	Standardized Coefficient	t-Statistic	Decision
	Tourist Engagement→Sustainability			
H1	Awareness	0.468*	7.113	Supported
	Tourist Engagement→Purchase			
H2	Intention	0.353*	2.911	Supported
	Tourist Engagement→Perceived			
H3	Naturalness	0.329*	4.458	Supported
	Sustainability Awareness→Purchase			
H4	Intention	0.050	1.165	Rejected
	Perceived Naturalness→Purchase			
H5	Intention	0.305*	7.491	Supported

Note: * $p < 0.05$.

5. Discussions

5.1 Theoretical Implications

The empirical findings of this study significantly advance the theoretical discourse on consumer behavior within the context of sustainable tourism, particularly by leveraging the Consumer Socialization Theory (CST). The validation of hypotheses concerning engagement's impact on sustainability awareness, perceived naturalness, and purchase intentions enriches our understanding of how tourists are socialized into embracing and acting upon sustainable practices in tourism settings (Ward, 1974; John, 1999). This not only confirms CST's applicability beyond traditional consumer markets but also highlights its utility in fostering environmental consciousness among tourists, a critical element in the pursuit of sustainable tourism development.

Notably, this research illuminates the nuanced pathways through which engagement influences sustainability-oriented outcomes. The positive association between engagement and sustainability awareness supports the notion posited by Moscardo (1996) that immersive experiences can significantly enhance tourists' understanding and valuation of sustainability. This linkage echoes findings from prior studies, such as those by Li et al. (2020), which underscore the importance of experiential learning in shaping consumer attitudes towards environmental stewardship. Furthermore, the study's observation that sustainability awareness does not directly lead to purchase intentions resonates with the insights from Kleinhüchelkotten (2019), who found that even when sustainable products are recognized for their safety, healthiness, and quality, there remains a notable reluctance

among consumers. This suggests a complex relationship between awareness and behavioral intention that requires further investigation. Additionally, the study extends the application of CST by demonstrating how direct experiences, reflective of engagement in the vertical farm context, serve as pivotal learning moments that can alter tourists' consumption patterns towards more sustainable choices. The clear role of perceived naturalness in enhancing purchase intentions, suggests that the perception of naturalness itself is a significant factor that directly influences tourists' decision-making processes. This finding resonates with the work of Rozin et al. (2012), who highlighted consumers' preference for natural products, suggesting that perceptions of naturalness can significantly influence purchasing decisions within the realm of sustainable tourism.

By synthesizing these insights with additional literature, such as the work of Prentice et al. (2019) and Gummerus et al. (2012), which underscore the link between engagement and behavioral outcomes in various settings, this study contributes to a more comprehensive understanding of the mechanisms driving sustainable consumer behavior intention in tourism. It suggests that fostering engagement and enhancing perceptions of naturalness may be key strategies for promoting sustainability in vertical farm products and tourist destinations.

5.2 Practical Implications

The findings of this study bear significant implications for stakeholders within the Asian sustainable tourism and agriculture sectors, particularly in the context of vertical farms. The research highlights the pivotal role of tourist engagement in enhancing sustainability awareness, perceptions of naturalness, and, crucially, the intentions to purchase vertical farm produce. For operators of vertical farms in Asia, this underscores the necessity of curating immersive and interactive experiences that do more than just inform tourists about sustainable practices. By integrating aspects of the farm's natural environment into these experiences, such as showcasing the journey of produce from farm to table, operators can significantly impact tourists' perceptions and their propensity to purchase sustainable products. This approach not only aligns with the growing consumer demand for products that are both sustainable and natural but also leverages the cultural appreciation for nature prevalent in many Asian societies, enhancing the appeal of vertical farm products.

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enhancing the appeal of vertical farm products.

Moreover, the role of digital platforms in amplifying the message about the benefits of vertical farm products cannot be overstated, especially in a highly digitalized region like Asia. Utilizing social media and online marketing to share stories of sustainable practices, the naturalness of produce, and the positive environmental impact of vertical farming can significantly enhance visibility and attract a broader audience. Policymakers and educational institutions in Asia are also called upon to integrate sustainability education into tourism development plans actively. Collaborations that bring together vertical farms, local communities, and schools to promote environmental awareness can have far-reaching impacts, nurturing a culture of sustainability within the region. These educational initiatives could form a vital component of sustainable tourism, offering enriching experiences that go beyond the traditional tourist activities to include learning about sustainable living and conservation efforts. By fostering a deeper understanding and appreciation of sustainable agricultural practices among tourists and the local population, stakeholders can drive a more substantial shift towards sustainability in tourism and consumption patterns, ultimately promoting the economic and environmental well-being of the region.

This study explored the relationship between tourist engagement, sustainability awareness, perceived naturalness, and purchase intention within the context of vertical farming tourism in Asia. It revealed that tourist engagement significantly enhances sustainability awareness, the perception of naturalness, and subsequently, the intention to purchase vertical farm produce. However, it identified that sustainability awareness does not directly translate into purchase intention without the influence of perceived naturalness. These findings underscore the critical role of engaging and educational experiences in shaping tourists' perceptions and behaviors towards sustainable agriculture, highlighting the importance of perceived naturalness in the consumer decision-making process. This research contributes to the theoretical and practical understanding of sustainable tourism and agriculture, offering insights into strategies that can promote environmental stewardship and sustainable consumer practices.

5.3 Limitation and Future Research

This research has shed light on the impact of tourist engagement and perceived naturalness on the purchase intention of vertical farm produce, particularly within the Asian context. Despite its contributions, several limitations need to be addressed in future studies:

1. The current study is anchored on Consumer Socialization Theory (CST) to explore the relationship between tourist engagement, sustainability awareness, perceived naturalness, and purchase intention. Future research could benefit from incorporating additional or alternative theoretical perspectives, such as the Theory of Planned Behavior (TPB) or the Value-Belief-Norm (VBN) Theory, to provide a deeper or different understanding of consumer behaviors in the context of sustainable tourism and agriculture.
2. The study's focus on Malaysia and the Greater Bay Area of China, while offering a unique context, may limit the generalizability of the findings to other geographical locations with different cultural

backgrounds and levels of sustainability awareness. Future studies could expand the research scope to include diverse cultural settings, enhancing the understanding of global consumer behavior towards vertical farming and sustainable agriculture.

3. The current study provides a general overview without delving into specific demographic or psychographic segmentations. Future studies could perform cross-analyses based on gender, age, income, education, and other relevant factors to uncover nuanced insights into how different groups perceive and engage with vertical farming tourism.

4. The study opens avenues for investigating other potential mediators and moderators in the relationship between tourist engagement and purchase intention, such as emotional connection, trust in sustainability claims, and the influence of social media. Exploring these factors could offer a deeper understanding of the mechanisms driving consumer behavior in the context of sustainable tourism and vertical farming.

5. This study primarily utilizes a quantitative approach. Incorporating qualitative methods, such as interviews or focus groups, in future research could provide deeper insights into the motivations, perceptions, and experiences of tourists engaging with vertical farms, thereby enriching the quantitative findings.

Acknowledgement

The authors are grateful for the support received from the Hunan Provincial Department of Education, Higher Education Division, which funded their work under the “Hunan Students' Innovation and Entrepreneurship Training Program”, with the grant number (202210545004).

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