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Exploring AAM Acceptance in Tourism: Environmental Consciousness's Influence on Hedonic Motivation and Intention to Use

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Abstract: Tourist destinations thrive on sustainable development. Electric vertical take-off and landing (eVTOL) aircraft, representing energy-efficient advancements in aviation that are pivotal to advanced air mobility (AAM), have garnered attention. Yet, the discourse on eVTOLs' role in tourism remains scant. This study, drawing from 450 samples in the Mogan Mountain Scenic Area, introduces the AAM-tourism acceptance model (ATAM). It integrates the theory of planned behavior (TPB) and technology acceptance model (TAM) theoretical frameworks, incorporating environmental consciousness, perceived safety, hedonic motivation, and personal innovativeness, assessing their influence on tourists' eVTOL usage intention through a structural equation model (SEM). The results reveal that environmental consciousness significantly impacts hedonic motivation and perceived usefulness, driving eVTOL adoption. Furthermore, personal innovativeness influences intention through hedonic motivation and perceived behavioral control. Therefore, environmental consciousness and hedonic motivation align deeply with eVTOL attributes, both significantly positively influencing intention to use. Thus, the study validates eVTOL's viability in tourism and its potential for sectoral expansion. Moreover, it offers insights into how psychological factors shape eVTOL adoption, guiding the promotion of eVTOL sightseeing services and informing research on AAM acceptance across various domains.

Keywords: tourism; advanced air mobility; electric vertical take-off and landing aircraft; ATAM; environmental consciousness; theory of planned behavior; technology acceptance model; structural equation model

Citation: Suo, Y.; Li, C.; Tang, L.; Huang, L. Exploring AAM Acceptance in Tourism: Environmental Consciousness's Influence on Hedonic Motivation and Intention to Use. *Sustainability* **2024**, *16*, 3324. https://doi.org/10.3390/su16083324

Academic Editor: Richard Tay

Received: 14 March 2024
Revised: 13 April 2024
Accepted: 15 April 2024
Published: 16 April 2024

1. Introduction

As advancements in technologies such as electric propulsion and autonomous driving continue, the emergence of electric vertical take-off and landing (eVTOL) aircraft products [1,2] has raised the prospect of realizing advanced air mobility (AAM) [3]. Due to the characteristics of eVTOL, including high speed and independence from ground congestion, numerous studies predict significant development potential for AAM in areas such as logistics [4–6], flying cars [7], and transportation [8–12].

However, the lack of user acceptance remains one of the primary obstacles to the adoption of eVTOL services [13]. Public acceptance is a prerequisite for the feasibility of the AAM market, and enhancing public perception is crucial for the widespread adoption of eVTOL services [14]. Therefore, it is necessary to study the public's intention to use eVTOL and determine its influencing factors, as well as analyze the interactions among these factors, which will provide a foundation for subsequent related research.

In this context, scholars have extensively studied the demand for eVTOL applications in urban settings. Researchers have explored its application in urban commuting [15,16], with predictions showing that the market share of AAM in various commuting modes does not exceed 1.3% at different distances, and the economic benefits of AAM in airport shuttle services are not ideal [17]. The stakeholders' expectation of using eVTOL in densely populated areas to alleviate commuting pressure and gain economic benefits can only be achieved when eVTOL is operated on a large scale [16]. Therefore, AAM services are currently more suitable for specific markets [18], such as emergency vehicles or long-distance travel between remote areas with underdeveloped transportation networks.

We recognize that applying eVTOL in the tourism consumer market may be a promising option. Transportation is an essential aspect of tourism, and research suggests that tourists traveling to and within destinations are potential users of eVTOL [19]. Surveys indicate that tourists arriving at destinations using different modes of transportation exhibit distinct consumption patterns [20–22]. The development of transportation infrastructure in tourist areas is positively correlated with local tourism revenue, as people are more willing to spend while traveling [23–26].

However, there is limited research on the acceptability of AAM during travel within the existing knowledge base. Additionally, in the context of sustainable consumption [27,28]—particularly within the tourism industry that emphasizes delivering pleasure as its product [29]—it is crucial to investigate whether AAM, as a representative eco-friendly transportation method, can garner tourist interest. Public acceptance is a prerequisite for market feasibility, and understanding the psychological factors influencing tourists' adoption of eVTOL can inform prudent investment and strategic business decisions [14].

Therefore, this paper establishes the AAM-tourism acceptance model (ATAM) based on the expanded TPB-TAM integration model to explore the factors influencing the acceptability of eVTOL in tourism, with tourists as the target group. The model extends the TPB-TAM framework by incorporating hedonic motivation, perceived safety, and personal innovativeness, while also considering the distinctive environmental consciousness prevalent in tourism. Structural equation modeling is employed to analyze the impact of these factors on tourists' willingness to use eVTOL and the interactions among them. The study aims to identify suitable application scenarios for eVTOL, a novel transportation mode, and to elucidate the behavioral intentions behind its usage. Additionally, the research provides empirical evidence in the domain of eVTOL acceptability in mountainous scenic areas.

The structure of this study is as follows: Section 1 is the introduction. Section 2 reviews the relevant literature. Section 3 presents the theoretical background, the model structure of this study, and proposes hypotheses. Section 4 introduces the methods of data collection and analysis. Section 5 presents the analysis results of the model. Section 6 discusses the model results. Finally, Section 7 summarizes the significance, limitations, and future prospects of this study.

2. Literature Review

2.1. Technological Adoption Models

Many models have been developed to explain human behavior and willingness to use new technologies. The well-known theory of planned behavior (TPB) [30] and technology acceptance model (TAM) [31] both stem from the theory of reasoned action (TRA) [32]. TPB is primarily used to predict and understand human behavior and is one of the most fundamental conceptual models in the field. TPB posits that the main factors influencing human behavior are the intention to use (IU), which is determined by attitude (AT), subjective norm (SN), and perceived behavioral control (PBC) [33]. TAM was initially developed to analyze users' acceptance of computer information technology and is now widely used to explain the extent to which users are willing to accept and use emerging technologies [34]. TAM suggests that AT determines users' intention to use new technology, which in turn determines actual usage. Attitude is controlled by two constructs, perceived usefulness (PU) and perceived ease of use (PEoU), with PEoU enhancing PU. TAM was further expanded into the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. [35]. They then added hedonic motives (HMs), price value, and habit structures to create UTAUT2 [36].

TPB and TAM both originate from TRA and share some common structures. The two models can theoretically be compatible. Chen et al. combined TPB and TAM, demonstrating that their combination can better explain people's willingness to use autonomous vehicles [37]. Currently, TPB and TAM are widely applied in various fields, including environmental science [38,39], consumer marketing [40], transportation [41–43], and tourism management [44]. Therefore, this study combines these two models to investigate tourists' willingness to use eVTOL. Considering that AAM operations are still under discussion and most tourists have not experienced eVTOL sightseeing during their journeys, with a lack of a systematic understanding of eVTOL and AAM, this study does not focus on attitude and perceived ease of use.

2.2. Factors Affecting User Acceptance of AAM

In recent years, researchers have been exploring the public's willingness to adopt AAM technology [45,46]. Table 1 summarizes research related to the fields of AAM, tourism and environmental protection. Both the academic and industry communities envision AAM applications in urban settings, including commuting at various distances above the city [15], airport shuttle services [17], and tourism sightseeing [19]. However, Fu's predictions indicate that the modal share of AAM in various commuting modes at different distances never exceeds 1.3% [15], and the economic benefits of AAM in airport shuttle services are not very promising [17]. Their conclusions suggest that the application of eVTOLs in commuting scenarios relies on well-established infrastructure and management networks, including high-density take-off and landing sites, supporting facilities, and landing routes constrained by the high population density and varying height structures within cities. This can lead to safety issues, management problems, and elevated costs (but still lower than helicopters) [15,47]. Tepylo et al. [14] reviewed public perceptions of AAM and analyzed factors that may influence people's views on AAM, noting that increasing public awareness is key to widespread adoption of this technology.

Table 1. Previous research on the acceptance of AAM, tourism and environment.

Authors(s)	Location (Sample Size)	Object	Model	Additional Constructs
TEZ et al. [19]	Turkey (270)	AAM	TAM (Extended)	UAM conceptual intention, general reliability, environmental consciousness.
Ju [42]	Korea (292)	AAM	TAM	** technology, safety, *** trust, *** cost, infrastructure, noise.
Al Haddad et al. [43]	Europe (221)	AAM	TAM (Extended)	Perceived reliability of automation, perceived vehicle safety, perceived locus of control, trust/value of safety, perceived costs, value of time, data and ethical concerns.
Ariza-Montes et al. [46]	U.S. (411) and China (400)	AAM	UTAUT (Extend)	** effort expectancy, ** attitude, ** social influence, ** perceived safety, ** pro-environmental behavior, ** openness to change.
Rohlik et al. [48]	Online (321)	AAM	TAM (Extended)	Time saving, ** travel cost, perceived safety, ** personal innovativeness.
Yavuz [49]	Online (360)	AAM	UTAUT (Extend)	*** personal innovativeness, *** perceived safety, *** hedonic motivation.
Chancey [50]	n.m. (240)	AAM	TAM (Extended)	*** Trust in UAM automation (performance, process, purpose), *** trust in UAM pilots (performance, process, purpose), *** perceived risk, willingness to fly, automation complacency–potential.

Table 1. *Cont.*

Authors(s)	Location (Sample Size)	Object	Model	Additional Constructs
Edwards [51]	U.S.	AAM		Passenger perceptions of safety, vehicle motion, noise and vibration, availability and access, passenger well-being.
Yavas et al. [52]	Online (348)	AAM	TAM (Extend)	*** UAM affordability, *** UAM conceptual intention, *** environmental consciousness, *** general reliability.
Kim et al. [53]	Online (450)	AAM	TAM (Extend)	*** attitude, *** perceived usefulness, *** perceived ease of use, *** time saving, *** availability, *** trust, *** safety, * perceived cost, *** flight comfort, *** resilience, *** reliability.
Abou Kamar et al. [39]	Egypt (360)	Tourism	TPB-TAM	** perceived enjoyment, ** sustainability knowledge.
Gansser et al. [38]	German (14,233)	Entertainment	TPB (Extend)	*** consumption, *** energy, *** food, *** mobility, *** egoistic concern, *** altruistic concern, *** biospheric concern, *** new ecological paradigm.
Emekci [40]	Turkey (272)	Entertainment	TPB	Environmentally conscious consumer behavior, *** green purchase intention, perceived consumer effectiveness, *** environmental concern, environmental knowledge, *** green buying behavior.
Chen et al. [54]	U.S. (711)	Entertainment	TAM-SETA (Extend)	Perceived cost, *** perceived risk to privacy, electricity curtailment habits, trust in utility companies, *** problem perception, ** political orientation.

n.m. (not mentioned), n.s. (non-significant), * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Urban air mobility (UAM) is one of the most challenging aspects of AAM while flying in urban areas.

In studying the psychological factors influencing the public's use of AAM, some research has employed latent variables such as SN, PBC, and PU from traditional models like TPB or TAM. Subsequently, many researchers have optimized these traditional models to better explain the key factors influencing the public's use of AAM. Optimization methods mainly include incorporating new constructs into the model or considering mediation or moderation effects between constructs.

Ju [42], based on the TAM model, analyzed users' acceptance of AAM, with the results indicating that technology safety significantly influences user acceptance. Rohlik [48] extended TAM and found that personal innovativeness (PI) is one of the main influencing factors of user intention to use. Yavuz [49], based on the extended UTAUT model, similarly found that PI significantly influences user intention to use. Chancey [50], through extending TAM, found that factors perceived risk and trust are important determinants of intention to use. Additionally, the research of many scholars has consistently demonstrated that perceived safety (PS) is an important influencing factor of user intention to use [42,43,48–51].

Cassar [55] indicates that individuals' pro-environmental attitudes are one of the most common factors determining travel modes. Owczarzak et al. [56] found in their research that environmental friendliness is a key factor in developing and implementing new public transportation systems. Lineberger et al. [57] anticipate that electric transportation will feature energy-saving and pollution-free characteristics. Straubinger et al. [13] discovered in their study that when transporting three or more passengers, eVTOLs will cause less pollution compared to fuel and electric cars. Hogreve et al. [58] concluded through qualitative research that environmental protection is a crucial factor in determining the use of UAM. Pukhova [59] argues that when the electricity consumed by eVTOLs is entirely derived from renewable energy sources, they will not impose any burden on the environment and, instead, will reduce carbon dioxide emissions. Zhao et al. [60], through a sensitivity analysis of a case study in the Tampa Bay region, validated that the public acceptance of AAM depends on how it addresses environmental impacts, primarily noise and emissions.

Based on the above research, TEZ et al. [19], Yavas et al. [52], and others focused on analyzing the application of AAM in leisure and entertainment. Environmental consciousness (EC) was introduced into TAM and was found to significantly influence user intention to use. Ariza-Montes et al. [46], based on an extension to UTAUT, also confirmed that pro-environmental behavior is an important influencing factor of intention to use.

2.3. Factors Affecting User Acceptance in Tourism

Tourism offers individuals the opportunity to explore new environments and engage in different experiences. Unlike commuting, people are more willing to spend money and time during travel to fulfill emotional values and seek happiness [29]. Tourists in a tourism setting are potential consumers of various sightseeing experiences. Compared to other modes of transportation, eVTOL provides a novel perspective, allowing passengers to enjoy scenery in areas inaccessible by ground transportation. eVTOL services themselves constitute important tourist attractions. Hedonic motivation (HM), defined as the fun or pleasure derived from using a technology, has been shown to play a crucial role in determining technology acceptance and use [36]. Yavuz [49] suggest that passengers' HM will significantly impact their willingness to use AAM. Ribeiro et al. [61] posit that passengers' HM will significantly influence their willingness to use autonomous vehicles during tourism.

In the tourism industry, it is time for managers to start recognizing environmental improvement as an economic and competitive opportunity, rather than an annoying cost or inevitable threat [62]. Environmental preservation, socio-cultural responsibility, economic resilience, enhanced travel experiences, and global collaboration form the tapestry of sustainability in the tourism sector [63]. Embracing sustainable practices is not merely an option but a necessity for the longevity and vitality of the tourism industry [64]. On the other hand, the quality of the travel experience itself is profoundly impacted by sustainability initiatives. Travelers are increasingly conscientious, seeking authentic and responsible experiences that align with their values [65]. Sustainable tourism caters to this demand by offering unique, culturally immersive experiences that promote environmental stewardship. Green certifications, eco-friendly accommodations, and responsible tour operators enhance the overall travel experience, allowing tourists to engage with the destination in a meaningful way [27]. Hence, it can be inferred that there may be a correlation between EC and HM.

At present, helicopters are widely used in tourism projects, enabling passengers to complete round-trip travel and scenic flights at destinations [62]. However, due to high fuel consumption and frequent accidents, helicopters have faced challenges in their positioning for civilian use, making it difficult to meet the concept of sustainable and environmentally friendly development in scenic areas [66]. The functionalities of eVTOLs are similar to helicopters, but they offer higher safety performance. Moreover, their electric propulsion reduces reliance on fossil fuels, resulting in a more environmentally friendly and quieter experience [67,68]. The energy efficiency of eVTOLs aligns with the principles of urban sustainability. Their comfortable riding experience and scenic views provide passengers with significant emotional value. Therefore, eVTOLs have the potential to be a competitor to helicopters in this field. Currently, over 250 institutions are developing flying cars and eVTOLs, with at least some vehicles expected to be commercialized soon [1]. The development of eVTOLs brings operational and safety challenges. To ensure the safe and efficient operation of AAM systems, numerous studies propose frameworks for integrating operations, infrastructure, and air traffic systems in future air transportation and offer feasible solutions [69,70]. Additionally, many researchers focus on the safety of eVTOLs, proposing their own solutions in areas such as regulation and certification, overall vehicle safety, and collision risk mitigation [71–73]. Research by Bas evaluates the potential of flying cars in the Southeast Asian market, suggesting that introducing leisure/sightseeing services may be most ideal [74]. Tan et al. [75] demonstrates the technical feasibility of using eVTOLs for cross-border tourism between Singapore and Malaysia, as well as between Singapore and Indonesia.

Consequently, we infer that eVTOLs are more suitable for tourism scenarios. Firstly, tourism provides individuals with positive experiences of encountering new environments and things. People are more willing to spend money or time on travel for emotional value and happiness compared to other activities [29], aligning with the characteristics of eVTOL [48]. Secondly, as a flying vehicle, eVTOLs are more competitive than helicopters in terms of safety, cost-effectiveness, and comfort. Tourists can spend less money on a quiet, comfortable, and high-visibility flight experience which is highly secure [67,68]. Thirdly, eVTOL facilities can be effectively placed in low-population-density tourist areas [3]. However, it is challenging to find studies on the acceptance of eVTOL applications in the tourism sector. Tourism, as an important means of novel experiences, allows people to experience the safety, efficiency, and sustainability of eVTOLs in a relaxed environment. This could serve as a suitable avenue for the promotion of eVTOLs. Quantifying and analyzing people's acceptance of eVTOLs in a tourism setting would help reflect the demand for new modes of transportation, providing a more practical development direction and research focus for the advancement of new technologies [76–78].

3. AAM-Tourism Acceptance Model and Hypotheses Development

3.1. AAM-Tourism Acceptance Model

In research on AAM acceptability, the most common extension to behavioral models is the inclusion of perceived safety and personal innovativeness constructs. Currently, the literature on AAM user acceptability is still evolving, with many studies focusing on exploratory surveys or establishing theoretical frameworks. Therefore, this study established the AAM-tourism acceptance model (ATAM) to provide empirical evidence regarding the framework of AAM acceptability during travel, as illustrated in Figure 1.

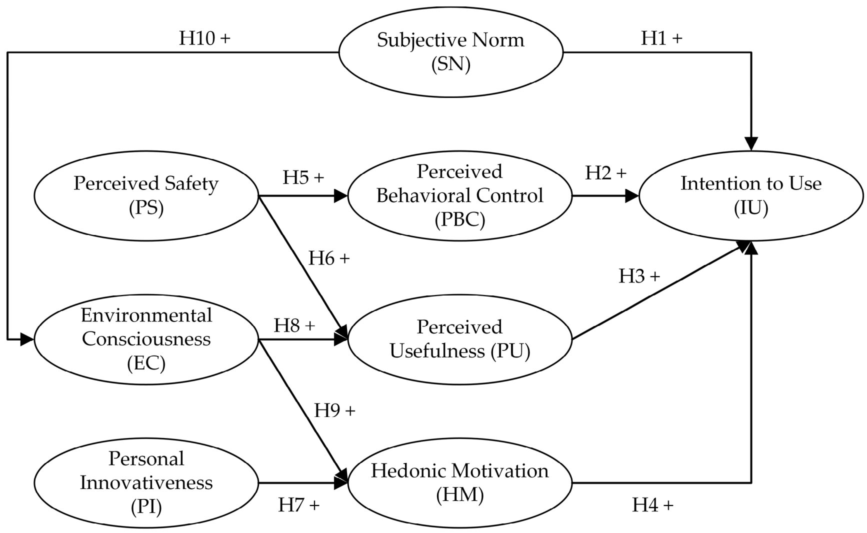

Figure 1. The AAM-tourism acceptance model.

ATAM, an extension of the TPB-TAM model, incorporates eight constructs such as HM, EC, PS, and PI. The aim is to is to provide a more comprehensive explanation of tourists' willingness to use eVTOLs. Given that AAM operations are still under discussion and most travelers have not experienced eVTOL sightseeing during their journeys, lacking systematic understanding of eVTOLs and AAM, this study does not focus on attitudes and perceived ease of use. Ten hypotheses were proposed based on the research background and model structure, which were subsequently tested.

3.2. Hypotheses Development

SN is one of the independent constructs of TPB, defined as a person's perception that most people who are important to them think they should or should not perform the behavior in question [30]. Previous research has already demonstrated the significant influence of SN on the intension to use eVTOLs [48,49]. Therefore, the following hypothesis is proposed:

H1. *Tourists' SN has a significant positive effect on their IU.*

Perceived behavioral control (PBC) is the second construct based on TPB, described as an individual's perceived ease or difficulty of performing a particular behavior [30]. Some studies have already demonstrated the significant impact of PBC on the intention to use eVTOL services [48,49]. Therefore, the following hypothesis is proposed:

H2. *Tourists' PBC has a significant positive effect on their IU.*

Perceived usefulness (PU) is a construct based on TAM, described as the degree to which a person believes that using a particular system would enhance their job performance [79]. The impact of PU on the intention to use eVTOLs has been found to be significant [43,48,49,53,80–82]. Therefore, we propose the following hypothesis:

H3. *Tourists' PU of eVTOLs has a significant positive effect on their IU.*

ATAM extends the TPB-TAM framework, with the first additional construct being hedonic motivation derived from UTAUT2, defined as the fun or pleasure derived from using a technology, and it has been shown to play an important role in determining technology acceptance and use [36]. Recent studies have confirmed the significant impact of hedonic motivation on the intention to use eVTOLs [83,84]. Therefore, we propose the following hypothesis:

H4. *Tourists' HM has a significant positive effect on their IU.*

PS refers to the degree to which an individual believes that using a system will affect their well-being [49]. In parallel with research on eVTOL technology, perceptual safety has consistently been identified as the primary concern for passengers [50,51,53]. Meanwhile, research has shown that individual perceived safety is associated with the functionality and utility of the technology [81]. Additionally, it is also linked to passengers' personal perceptions [81,82]. Consequently, we postulate the following:

H5. *Tourists' PS of eVTOLs has a significant positive impact on their PBC.*

H6. *Tourists' PS of eVTOLs has a significant positive impact on their PU.*

PI is described as a characteristic and willingness of an individual to try innovative and new technology [85,86]. Rohlik [48] suggests that PI similarly influences passengers' choices regarding AAM. Research has demonstrated a correlation between users' personal innovativeness and hedonic motivation when encountering new technology [87]. Therefore, we hypothesize the following:

H7. *Tourists' PI has a significant positive impact on their HM.*

Over the past few decades, numerous studies have sought to elucidate EC [88,89]. In the context of AAM, EC is defined as participants' environmental awareness in terms of the AAM system and is defined as individuals' tendency to use the AAM system to support environmental sustainability [52]. Some studies [81,82] demonstrate that EC significantly influences users' perceived usefulness of eVTOLs. Researchers [19,81] have proved the influence of EC on users' willingness to use eVTOLs for pleasure, while a study by Abou Kamar [39] showed that respondents' SN affected their EC. Therefore, we hypothesize the following:

H8. *Tourists' EC has a significant positive effect on their PU.*

H9. *Tourists' EC has a significant positive effect on their HM.*

H10. *Tourists' SN has a significant positive effect on their EC.*

4. Data and Methods

The primary objective of this study was to explore the complex relationships among various factors and the willingness to use eVTOLs in tourism settings. Although some related research exists, the relationships among these constructs in a tourism context remain unclear. Additionally, few studies have considered the impact of tourists' EC on IU. Therefore, building upon prior research, this study proposes the ATAM, validating this model through survey design and data collection.

4.1. Survey Design

Based on an analysis of the existing literature on user acceptance in the AAM and transportation domains, we designed a questionnaire using established scales. Considering the relatively low prevalence of eVTOL and AAM systems, we provided an introduction to the research purpose and briefly explained eVTOLs at the beginning of the questionnaire.

In April 2023, we conducted a pilot survey using the preliminary version of the questionnaire and analyzed the data from 50 responses. Based on the analysis, we eliminated 16 items with inadequate reliability and low factor loadings. Additionally, in response to participant feedback, we revised the explanation of eVTOLs to enhance clarity and simplicity. We also added assurances of the questionnaire's anonymity.

The formal survey questionnaire (refer to Appendix A) was divided into three sections. The first section included a brief introduction to the research purpose, an explanation of eVTOL and AAM systems to assist respondents in understanding the concepts, and a statement declaring the questionnaire's anonymity. It was emphasized that the questionnaire would not collect any personal information and the survey administrators would be unable to identify participants based on the questionnaire information after the survey concluded. The second section comprised 24 sub-questions across eight constructs (refer to Table A1), all designed as 7-point Likert scale items [90,91]. To ensure clarity, we presented these questions in the tabular format in Appendix A, with references cited. The third section pertained to personal demographic information, encompassing gender, age, education level, occupation, and monthly income, totaling five attributes. At the conclusion of the questionnaire, we extended our gratitude to the participants for their involvement in the study.

4.2. Data Collection

In May 2023, the research team conducted offline surveys in the Mogan Mountain Scenic Area in Huzhou, China. We determined the sample size [92] according to Formula (1).

$$n = \frac{z^2 \times S^2}{e^2 + z^2 S^2 / N} \tag{1}$$

In 2022, the Mogan Mountain Scenic Area received a total of 2 million visitors throughout the year [93]. With a sampling error of 5% and a confidence level of 95%, a survey was designed, resulting in a sample size of 400. Research by Barrett [94] suggests that the sample size should exceed 200. However, the chi-square value severely inflates when the sample size exceeds 500 in maximum likelihood estimation, leading to poor model fit. Therefore, the sample size should be between 200 and 500. We conducted simple random sampling within the scenic area, ensuring that all respondents were tourists as the survey took place within the area. Prior consent from all participants was obtained, ensuring the anonymity of the questionnaire. Researchers refrained from obtaining any personal information from respondents during and after the data collection process. Respondents were adequately informed about the research's purpose and given a preliminary understanding of eVTOL and AAM systems. To eliminate invalid surveys, two criteria were applied: Firstly, considering the practical time frame revealed during the pre-survey, which indicated that completing the questionnaire would take 3–5 min, responses within two minutes were deemed irresponsibly answered. Secondly, surveys where respondents consistently selected the same rating on all scale questions were excluded [95]. The final dataset comprised 450 valid samples.

Descriptive statistics for the surveyed participants are presented in Table 2:

Table 2. The results of descriptive statistics.

Demographic Variable	Value Set	Frequency	Proportion (%)
Gender	Male	216	48.0
	Female	234	52.0
Age	Below 18	52	11.6
	18–30	156	34.7
	31–50	119	26.4
	51–64	91	20.2
	Above 65	32	7.1
Education Level	Primary school	6	1.3
	Junior high	58	12.9
	Senior high	98	21.8
	Junior college	102	22.7
	Regular college	173	38.4
	Master	13	2.9
Occupation	Student	78	17.3
	Salaryman	186	41.3
	Senior	27	6.0
	Entrepreneur	27	6.0
	Freelancer	110	24.4
	Others	22	4.9
Monthly Income (CNY)	<1 k	5	1.1
	1–3 k	39	8.7
	3–5 k	73	16.2
	5–8 k	124	27.6
	8–10 k	93	20.7
	10–20 k	42	9.3
	Above 20 k	22	4.9
	Others	52	11.6
Total		450	100.0

Among the respondents, males accounted for 48%, while females accounted for 52%, indicating a relatively balanced gender distribution. The majority of respondents (61.1%) fell between the ages of 18 and 50, which may be attributed to limited mobility, resulting in fewer elderly and underage individuals participating in travel. The primary occupational group among the surveyed tourists was salaryman (41.3%), with most individuals earning a monthly income between 5 and 10 k. Both low- and high-income groups were less represented in the sample, possibly because individuals with low incomes lack sufficient funds for travel, while those with high incomes opt for exclusive access to scenic areas, isolating themselves from other tourists to enjoy their travels more efficiently.

4.3. Research Methodology

The structural equation model (SEM) [96] is commonly used for quantitative analysis of data. SEM incorporates two types of variables: manifest variables, for which specific values can be obtained through observation, and latent variables, which can only be derived through statistical methods from other correlated variables [97]. SEM combines confirmatory factor analysis (CFA) and path analysis, where CFA is a method for measuring latent variables [98]. It extracts latent constructs from other variables and shares the maximum variance with the relevant variables. Path analysis aims to quantify relationships between multiple variables [99] and can explain causal relationships between variables. A common function of path analysis is mediation, assuming one variable can directly or indirectly influence the outcome through another variable.

When the sample size exceeds 100, maximum likelihood estimation can be employed [100]. Therefore, since all the indicators were reflective and the sample size was sufficient, this study utilized the two-step covariance-based structural equation modeling (CB-SEM) technique combined with maximum likelihood estimation. The first step was composed of a measurement model. It consists of assessing construct validity and testing measurement model fit. The second step was composed of a structural model. It consists of testing the structural theory [101,102]. Measurement and structural models were analyzed using IBM SPSS AMOS 26.

5. Results

5.1. Measurement Model

Initially, an examination of the internal consistency and reliability, convergent validity, and discriminant validity of the data was conducted. Internal consistency was assessed using Cronbach's alpha (α) and Composite Reliability (CR). Data were deemed reliable when $\alpha > 0.7$ and CR > 0.7. Factor loadings (FLs) and Average Variance Extracted (AVE) were employed to assess convergent validity and discriminant validity. A model was considered to have good convergent validity when CR > 0.7, FL > 0.6, and AVE > 0.5 [102,103]. Specific data are detailed in Table 3.

Table 3. Results of statistical analysis and confirmatory factor analysis.

Constructs	Indicator	Unstd.	S.E.	*t*-Value	*p*	Factor Loadings (Std.)	SMC	Cronbach's Alpha	CR	AVE
PU	PU1	1.000				0.815	0.664	0.851	0.849	0.651
	PU2	1.007	0.059	17.027	***	0.806	0.650			
	PU3	0.996	0.059	16.940	***	0.800	0.640			
EC	EC1	1.000				0.729	0.531	0.819	0.818	0.600
	EC2	1.042	0.073	14.191	***	0.778	0.605			
	EC3	1.197	0.083	14.388	***	0.814	0.663			
PBC	PBC1	1.000				0.842	0.709	0.881	0.886	0.722
	PBC2	0.933	0.047	19.983	***	0.815	0.664			
	PBC3	0.891	0.041	21.854	***	0.897	0.805			
SN	SN1	1.000				0.815	0.664	0.857	0.849	0.652
	SN2	0.939	0.054	17.553	***	0.802	0.643			
	SN3	0.987	0.055	17.966	***	0.825	0.681			
HM	HM1	1.000				0.752	0.566	0.830	0.827	0.614
	HM2	1.092	0.072	15.069	***	0.798	0.637			
	HM3	1.077	0.071	15.087	***	0.800	0.640			
PS	PS1	1.000				0.804	0.646	0.844	0.836	0.630
	PS2	0.955	0.057	16.820	***	0.795	0.632			
	PS3	0.957	0.058	16.582	***	0.782	0.612			

Table 3. *Cont.*

Constructs	Indicator	Unstd.	S.E.	*t*-Value	*p*	Factor Loadings (Std.)	SMC	Cronbach's Alpha	CR	AVE
PI	PI1	1.000				0.802	0.643	0.853	0.852	0.657
	PI2	1.027	0.059	17.389	***	0.811	0.658			
	PI3	1.064	0.061	17.514	***	0.818	0.669			
IU	IU1	1.000				0.795	0.632	0.838	0.826	0.613
	IU2	0.960	0.063	15.322	***	0.765	0.585			
	IU3	1.010	0.065	15.641	***	0.789	0.623			

*** $p < 0.001$.

As shown in Table 3, all variables exhibit factor loading (FL) values surpassing the recommended threshold of 0.6. Additionally, Cronbach's alpha (α) values exceed the minimum recommended value of 0.7, while Composite Reliability (CR) and Average Variance Extracted (AVE) both surpass 0.7 and 0.5, respectively. These results signify the sample data's favorable internal consistency, indicating a high level of reliability, robust explanatory power for each factor, reasonable measurement errors, and strong convergence.

As illustrated in Table 4, the AVE square roots for each construct were greater than the correlation coefficients with other constructs, indicating a favorable level of discriminant validity. Overall, the effective sample data are well-suited for further investigation through model fitting studies. The model fit results are presented in Table 5.

Table 4. Convergent and discriminant validity results for the ATAM.

Constructs	IU	PI	PS	HM	SN	PBC	EC	PU
IU	0.783							
PI	0.473	0.811						
PS	0.482	0.479	0.794					
HM	0.413	0.456	0.402	0.784				
SN	0.449	0.416	0.439	0.392	0.807			
PBC	0.446	0.444	0.427	0.342	0.355	0.850		
EC	0.370	0.316	0.296	0.307	0.337	0.763	0.775	
PU	0.466	0.466	0.404	0.459	0.437	0.366	0.317	0.807

Table 5. CFA results of ATAM.

Item	Results	Criteria	Reference
CMID	661.905		
DF	239		
CMID/DF	2.765	<3	[104]
GFI	0.902	>0.9	[105]
AGFI	0.878	>0.8	[106]
CFI	0.925	>0.9	[105]
TLI (MNFI)	0.913	>0.9	[107]
RMSEA	0.063	<0.08	[107]
SRMR	0.062	<0.08	[108]

R-squared (R^2) represents the extent to which latent variables can be explained by other latent variables, serving as an indicator of the model's fitting effectiveness [50]. The results of ATAM explanatory power and significance analysis showed that IU:R^2 = 0.528, PBC: R^2 = 0.235, HM: R^2 = 0.212, PU: R^2 = 0.504, and EC: 0.141. Additionally, other metrics related to the AAM-tourism acceptance model can be found in Table 5.

5.2. Structural Model

The bootstrapping algorithm was employed with 5000 subsamples for sampling inspection. This process yielded path coefficients and T-values for the relationships between structures, consequently providing the results of hypothesis testing, as depicted in Table 6.

Table 6. Results of hypothesis testing.

Hypothesis	Path	Path Coefficients	*t*-Values (*t*)	Supported?
H1	SN→IU	0.245 ***	4.436	Yes
H2	PBC→IU	0.232 ***	4.546	Yes
H3	PU→IU	0.238 ***	4.439	Yes
H4	HM→IU	0.175 ***	3.301	Yes
H5	PS→PBC	0.460 ***	8.504	Yes
H6	PS→PU	0.399 ***	7.219	Yes
H7	PI→HM	0.428 ***	7.521	Yes
H8	EC→PU	0.212 ***	3.931	Yes
H9	EC→HM	0.204 ***	3.767	Yes
H10	SN→EC	0.375 ***	6.536	Yes

*** $p < 0.001$.

When the *t*-test value for the path coefficient exceeds 1.96, it is deemed to pass the significance test. As indicated in Table 4, the data substantiate the support for H1–H10, and all of them demonstrate high statistical significance. Therefore, the structural model results were obtained, as shown in Figure 2.

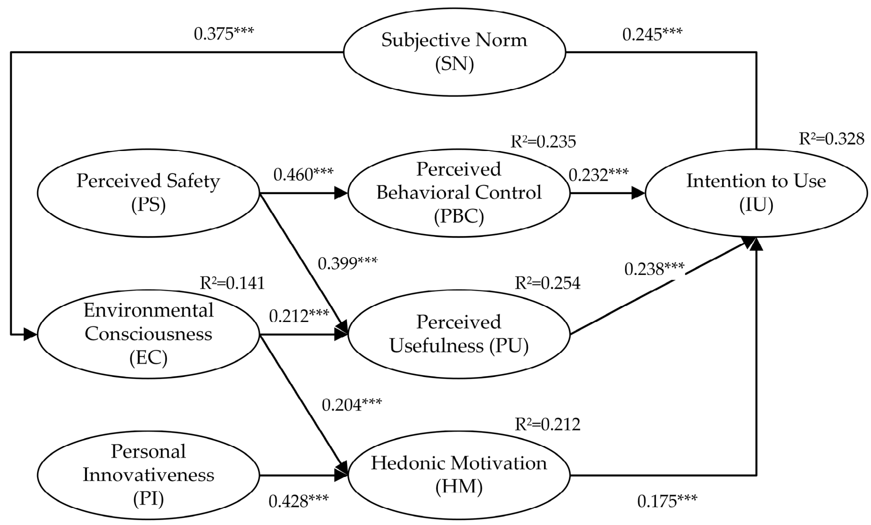

Figure 2. Structural model results. *** $p < 0.001$.

Analyzing the multiple mediation effects from SN to IU, the mediation effect structure is illustrated in Figure 3, and the results are presented in Table 7. It can be observed that both Path SN→EC→PU→IU and Path SN→EC→HM→IU significantly influence Path SN→IU, but the difference between them is not significant.

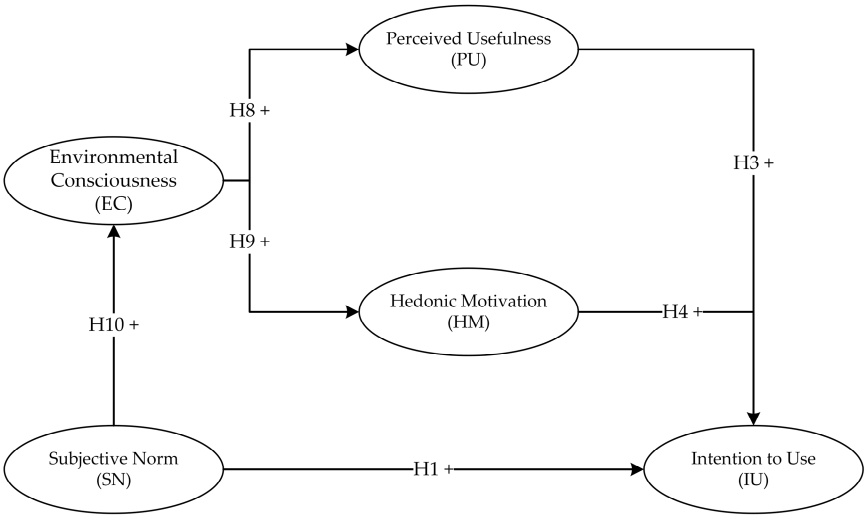

Figure 3. Serial mediation model testing the mediating effect of SN and IU.

Table 7. Results of the mediating effect.

Path	Std.	Bootstrapping 95% CI		*p*
		Lower	Upper	
SN→EC→PU→IU	0.023	0.011	0.040	0.000 ***
SN→EC→HM→IU	0.013	0.004	0.030	0.001 ***
Compared	0.010	−0.009	0.28	0.268

*** $p < 0.001$.

To identify the key factors and influence paths affecting tourists' willingness to use eVTOLs in a tourism environment, the bootstrapping algorithm was employed to calculate and summarize the total, direct, and indirect effects of all latent variables on the willingness to use eVTOLs, as shown in Table 8.

Table 8. Analysis of the effect of each variable on the intention to use eVTOLs in scenic spots.

Influencing Relationships	Direct Impact	Indirect Impact	Total Impact	Pathways to Significant Indirect Effects
SN→IU	0.227 ***	0.03 ***	0.262 ***	SN→EC→PU→IU;SN→EC→HM→IU;
PBC→IU	0.208 ***	-	0.208 ***	-
HM→IU	0.189 ***	-	0.189 ***	-
PU→IU	0.224 ***	-	0.224 ***	-
PS→IU	-	0.175 ***	0.175 ***	PS→PU→IU;PS→PBC→IU
EC→IU	-	0.119 ***	0.119 ***	-
PI→IU	-	0.073 ***	0.073 ***	-

*** $p < 0.001$.

The findings demonstrate that SN, PBC, HM, and PU all exert significant direct effects on IU. Moreover, PS, EC, PI, and SN each exhibit significant indirect effects on IU.

6. Discussion

6.1. Theoretical Implications

This study combined EC to construct ATAM to investigate tourists' willingness to use eVTOLs for sightseeing in a tourism environment. SEM was used to examine the impact of each latent variable on IU and hypothesis testing of the model. The results confirmed all ten hypotheses with data support. ATAM revealed that tourists' PU has significant positive effects on IU. This aligns with findings from studies on the willingness to use eVTOLs in various application scenarios [42,43,46,48,49], indicating that potential passengers, regardless of their location, tend to prioritize the mobility performance of AAM systems and consider whether they can meet their mobility needs. As mentioned by Behme et al. [81], when using eVTOLs as a mode of transportation, tourists may first need to go to an aerial taxi docking point. Therefore, they may criticize them for not being flexible enough in docking. As a result, tourists are likely to pay attention to the availability of eVTOLs and whether they can meet their mobility needs. They may perceive eVTOLs as less flexible compared to ground taxis.

Tourists' hedonic motivation significantly influences their intention to use, similar to findings from studies by Winter et al. [83], Radic et al. [84], and Yavuz [49]. This further corroborates that unlike commuting in urban areas, people prioritize enjoyment during travel [29]. This conclusion contradicts many studies in the field of autonomous vehicles [109], suggesting that, compared to autonomous cars, eVTOLs can offer a unique aerial perspective and access areas unreachable by ground transportation. They can in themselves be considered an attraction. In future research, we should focus on the hedonic attributes of this mode of transport while leveraging its advantages in passenger comfort.

Additionally, the population studied by Yavuz [49] consisted of students, who are perceived to possess high learning efficiency and openness to novelty. Therefore, students are considered a group with strong individual innovativeness. This aligns with the conclusion of this study that individual innovativeness significantly influences hedonic motivation. This is consistent with the conclusions of Rohlik et al. [48] and Stock et al. [87], which may offer insights into the potential user profile for AAM applications. This means that satisfying curiosity will bring joy to tourists with strong PI, making the advanced technology of eVTOLs particularly attractive to them. As analyzed by Stock et al. [87], individuals who seek enjoyment from innovative products may be more inclined to be early adopters of AAM.

PS significantly influences PU, indicating that stronger PS leads to a wider acceptance of eVTOLs as a mode of transportation. PS also significantly affects PBC, suggesting that the sense of control experienced during an eVTOL journey psychologically encourages passengers to choose it, consistent with the findings of Edwards [51] and Chancey [50]. However, this finding differs from studies by Kim et al. [53], Yavuz [49], and many in the field of autonomous vehicles, where the role of perceived safety in their AAM models appears to be weaker. This might be because safety is not the primary concern for individuals in a new and unfamiliar mode of transportation. Users may prioritize safety issues with autonomous vehicles because they are more familiar with this mode of transport [49]. Additionally, compared to the automation control of AAM, users' direct control over autonomous vehicles or their ability to interact with the environment and vehicles may emphasize safety perception. Enhancing users' understanding of AAM will help them evaluate this mode of transportation from a safety perspective. Future research should further explore the pathways through which perceived safety influences the intention to use urban air mobility.

Sustainable travel destinations are integral to positive experiences. Tourists' SN significantly influences their EC, similar to findings by Abou Kamar [39], which may be related to personal values and collectivism [110,111]. When individuals are among a group with similar values, they tend to align their behavior with the collective, while EC significantly affects HM, indicating that environmentally conscious tourists experience greater enjoyment when destinations advocate sustainable development, consistent with Yavas's [52] findings. As demonstrated in studies by TEZ et al. [19] and Emekci [40], individuals with environmental awareness are more likely to engage in environmentally conscious behaviors. HM significantly influences IU, prompting environmentally conscious tourists to choose eVTOL travel.

Furthermore, EC significantly influences PU, consistent with study of Behme et al. [81]. However, contrary to the findings of Kellermann et al. [82], this research indicates that participants emphasized their willingness to use AAM only when eVTOLs are harmless in all aspects (noise, air pollution, etc.). Some participants believed that drones represented a sustainable alternative technology. On the other hand, other participants expressed doubts about whether drones could meet environmental requirements. Clearly, breakthroughs in energy savings and noise reduction by eVTOLs will significantly enhance their perceived usefulness by users. Whether drones are indeed an environmentally friendly technology compared to helicopters, and thus whether eVTOLs have the potential to replace helicopters in tourism, remains to be seen.

6.2. Practical Implications

The significant impact of PU on tourist choice suggests that we should pay attention to the characteristics of eVTOL vehicles themselves. Compared to ground transportation modes such as scenic buses and railways, eVTOLs can easily reach remote and environmentally fragile areas without requiring extensive ground infrastructure. This feature makes it particularly suitable for operation in nature reserves and scenic areas where environmental protection is emphasized. Therefore, eVTOLs have unique advantages in meeting tourists' mobility needs, leading tourists to value their mobility performance and perceive their introduction as useful in scenic areas. However, currently, tourists need to walk to reach the landing points, so some tourists may find this mode of transportation inconvenient. This suggests that we should carefully select locations for ground infrastructure and plan routes reasonably to enhance the perceived usefulness of potential users.

Furthermore, eVTOLs enable people to appreciate scenery in unprecedented ways, and riding in an eVTOL itself becomes part of the travel experience. To some extent, they can be regarded as a novel attraction, so manufacturers and operators should actively leverage their comfort and experiential advantages. Stakeholders should emphasize the low noise and comfort of eVTOLs in their promotion efforts. Initially, they may only be chosen by a small segment of people open to novel experiences, so the primary target of promotion should be groups keen on personal innovation, such as those frequenting online communities popular among trendsetters and fashion enthusiasts. In this scenario, scenic areas could offer ground-based VR experiences to help more people gain exposure and overcome apprehensions. They could also design diverse, environmentally friendly gaming activities tailored to customer preferences and propose customized industry incentives, such as subsidizing experiential opportunities. These measures will enhance public confidence and trust in this form of tourism.

The significant impact of PS on tourists' choice of eVTOLs indicates the importance of establishing safety standards for the eVTOL tourism industry when eVTOLs enter the tourism market. Regular maintenance checks of equipment, including mechanical, electronic, and aviation equipment inspections and repairs, should be conducted to ensure the safety of passengers and staff.

Most natural scenic areas require environmental protection and the preservation of unique landscapes. Therefore, stakeholders should promote the characteristics of eVTOLs that align with these requirements, such as safety, energy efficiency, low noise emissions, and minimal impact on the scenic environment. Currently, sustainability is crucial for the tourism industry due to various interconnected reasons. Environmental conservation is a vital aspect of sustainable tourism development, and the eco-friendly nature of eVTOLs makes them suitable for providing sightseeing services in scenic areas. Emphasizing environmental protection in scenic areas itself attracts environmentally conscious tourists, and the introduction of eVTOLs as a sustainable mode of transportation can further enhance their interest and enrich their tourism experience.

This study elucidates the psychological factors driving tourists' adoption of eVTOLs. By integrating developments in the tourism and aviation sectors, it lends support to the commercialization of eVTOLs and sustainable development in tourism. Additionally, it enriches the literature on eVTOL applications in tourism and offers insights for the development of AAM in other domains.

6.3. Limitatious

This study has several limitations. Firstly, the respondents had limited knowledge of eVTOL and AAM systems, and the questionnaire could only provide respondents with an understanding through text and images, potentially leading to discrepancies between respondents' answers and their actual thoughts. Additionally, data collection was confined to the Mogan Mountain Scenic Area, which may not represent all types of scenic areas and tourists. These limitations may have introduced biases into the questionnaire results. Furthermore, eVTOLs and cable cars share similarities in functionality, warranting further analysis of tourists' preferences for them. This may require additional research in the future. Furthermore, eVTOLs are not yet widespread, and with technological advancements, factors influencing people's willingness to use them may change. This calls for further research in the future.

7. Conclusions

This study investigates tourists' acceptance of eVTOL sightseeing in tourist attractions. Determining suitable scenarios and potential user groups for eVTOLs is crucial for the future development of the AAM industry. However, research on eVTOL acceptance has mainly focused on urban commuting, neglecting their application in tourist attractions. Unlike busy commutes, tourists are more attuned to environmental conservation and sustainability in leisure settings. Beautiful surroundings enhance comfort and enjoyment, aligning with the eco-friendly requirements of tourist attractions. Thus, we developed ATAM, collecting data in tourist attractions to analyze tourists' acceptance of eVTOL sightseeing services.

Compared to previous models in transportation and tourism contexts, ATAM considers the relationship between new technology and leisure-oriented tourism. It integrates the EC variable into the TPB-TAM framework, hypothesizing H8, H9, and H10, and analyzes EC's impact on IU, validated through SEM. Hence, ATAM accurately analyzes tourist acceptance of clean energy technology.

Offering eVTOL tourism projects in tourist attractions is a viable option. The ATAM results indicate that SN significantly influences EC, which, in turn, significantly affects HM and PU, indirectly impacting tourists' willingness to use eVTOLs. Social advocacy deepens EC, enhancing enjoyment for tourists advocating sustainable tourism destinations, thereby increasing the likelihood of choosing eVTOLs. Stronger environmental consciousness also convinces people of the usefulness and necessity of eco-tourism projects in attractions, prompting them to choose eVTOLs for travel.

Author Contributions: Y.S.: conceptualization, data curation, formal analysis, investigation, methodology, software, visualization, writing—original draft, writing—review and editing. C.L.: funding acquisition, resources, validation, writing—review and editing. L.T.: methodology, validation, writing—review and editing. L.H.: project administration, supervision. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Natural Science Foundation of China under Grant No. 52102384, the Natural Science Foundation of Sichuan Province (No. 2023NSFSC0903), Fundamental Research Funds for the Central Universities of China: ZJ2021-03, Key Laboratory of Flight Techniques and Flight Safety, Civil Aviation Administration of China (Grant NO. FZ2022KF10) and Vehicle Measurement, Control and Safety Key Laboratory of Sichuan Province under Grant No. QCCK2022-003.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to restrictions, e.g., privacy or ethics.

Acknowledgments: We gratefully acknowledge the support of the School of Air Traffic Management, Civil Aviation Flight University of China, and School of Automobile and Transportation, Xihua University, for this research.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Dear tourist,

Thank you for participating in this survey. We are researchers from the IATAP team at the Civil Aviation Flight University of China. The purpose of this survey is to understand your willingness to use electric vertical take-off and landing aircraft (eVTOL) for sightseeing in scenic areas. Your responses will be crucial to our study.

eVTOL has emerged in recent years as an aircraft that utilizes electric power as either its sole or partial propulsion source. It features a compact size and lower infrastructure requirements compared to traditional civil drones and helicopters. Notably, eVTOL operates on clean energy sources, resulting in reduced noise levels and greater environmental friendliness. It can be simplistically viewed as an electrically powered helicopter. Within scenic areas, passengers have the option to choose eVTOL for sightseeing purposes. Its appearance can be referenced in the following images:

Figure A1. Appearance of the eVTOL.

You can also click on https://www.wenjuan.com/s/BFVNbqq/# (accessed on 29 March 2023).to watch the eVTOL sightseeing video.

In the questionnaire, "sightseeing" refers to various ways of touring and exploring within the scenic area. The survey will take approximately 4 min of your time, and questions 1–24 of this survey do not involve right or wrong answers. Please read carefully and quickly select the option that best reflects your feelings. This survey will take about 4 min and does not involve any commercial activities or disclosure of your information.

If you fully understand this study and are willing to participate in the survey, please answer the following questions based on your genuine thoughts.

Table A1. Analysis of the effect of each variable on the intention to use eVTOLs in scenic spot.

Constructs	Items	Contents	References
Perceived Usefulness (PU)	PU1	I think it can avoid congestion.	[48,49,54]
	PU2	I think it provides effective access to tourist attractions.	
	PU3	I think it helps me achieve my travel goals more efficiently.	
Subjective Norm (SN)	SN1	I would use it if the majority of people use it.	[40,49]
	SN2	I would use it if people around me use it.	
	SN3	Society will support the development of this industry.	

Table A1. *Cont.*

Constructs	Items	Contents	References
Perceived Behavioral Control (PBC)	PBC1	I have sufficient knowledge to use this service.	[9,38]
	PBC2	I have sufficient skills to use this service.	
	PBC3	I have sufficient financial means to use this service.	
Hedonic Motivation (HM)	HM1	I think interesting things can happen during the journey.	[49,112]
	HM2	I think it is an experience worth showcasing.	
	HM3	I think it feels very comfortable.	
Perceived Safety (PS)	PS1	If an accident occurs, I don't think it's the fault of eVTOL.	[48,49,54]
	PS2	I am not worried about accidents happening.	
	PS3	I feel safe using it.	
Personal Innovativeness (PI)	PI1	I can proficiently use a smartphone app.	[48,49,54]
	PI2	Technology will solve many problems for us.	
	PI3	I am often one of the first to try new technologies.	
Environmental consciousness (EC)	EC1	I am very concerned about reports on energy sustainability issues.	Based on the questionnaire adjustments made by [38–40].
	EC2	Energy and sustainability issues are societal problems, and everyone has a responsibility.	
	EC3	Energy resources are limited, and if we do not control our usage at the current rate, humanity will face energy depletion in the future.	
Intention to Use (IU)	IU1	I plan to use eVTOL sightseeing services in the future.	[48,49,54]
	IU2	I would spend more money on eVTOL travel services than traditional sightseeing methods.	
	IU3	I would recommend eVTOL travel services to my family and colleagues.	

Please respond to the following five single-choice questions based on your real circumstances.

Your gender? *

○ Male ○ Female

What is your age? *

○ Below 18 years old ○ 18–30 years old ○ 31–50 years old

○ 51–64 years old ○ 65 years old and above

What is your highest level of education (including current enrollment)? *

○ Primary school ○ Junior high ○ Senior high ○ Junior college

○ Regular college ○ Master

What is your occupation? *

○ Student ○ Salarman ○ Senior ○ Entrepreneur

○ Freelancer ○ Others

What is your current personal monthly income after taxes (including various sources of income such as pocket money, part-time income, etc.)? (Unit: CNY) *

○ Below 1 k ○ 1–3 k ○ 3–5 k ○ 5–8 k ○ 8–10 k ○ 10–20 k

○ Above 20 k ○ Currently no income (e.g., student)

You have completed our questionnaire, and we sincerely appreciate your patience in answering and your contribution to our academic work!

If you have any questions regarding our survey or if you are interested in our research group and related studies, please feel free to contact us via email at syn@cafuc.edu.cn.

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