Transportation Research Part F: Psychology and Behaviour 110 (2025) 88–103

Contents lists available at ScienceDirect

Transportation Research Part F: Psychology and Behaviour

journal homepage: www.elsevier.com/locate/trf

Societal acceptance of advanced aerial mobility in China's Greater Bay Area among young- and middle-aged adults

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ARTICLE INFO

Keywords:
Advanced aerial mobility
Advanced air mobility
Urban air mobility
Technology acceptance
Trust
Theory of planned behavior

ABSTRACT

In an era of rapid urbanisation and technological innovation, Advanced Aerial Mobility (AAM) – an innovative transport mode utilising electric vertical take-off and landing (eVTOL) aircraft – has evoked debates about its the potential to address various urban transportation challenges. This study examines the societal acceptance of AAM in China's Greater Bay Area (GBA), a region grappling with air pollution, traffic congestion, and cross-border mobility issues. By synthesising the Theory of Planned Behaviour (TPB) and Technology Acceptance Model (TAM), we propose an extended model that incorporates trust as a crucial construct. The proposed model was tested with a survey of 988 young- to middle-aged GBA residents, and structural equation modelling results confirmed the model's validity, explaining 61% of the variance in AAM usage intention. In the proposed model, all TPB and TAM factors are significant, while trust emerged as the most significant factor in explaining the acceptance of AAM. Multigroup analyses offered further insights: perceived usefulness and subjective norms significantly influence young adults' intentions, while perceived behavioural control plays a pivotal role in shaping men's inclination towards AAM adoption. These findings not only contribute to the theoretical understanding of technology acceptance but also offer valuable practical implications for informing the design, implementation, and regulation of AAM development in the GBA and beyond. By illuminating the factors driving AAM acceptance, this study paves the way for reimagining the future of urban mobility.

1. Introduction

Transportation systems are increasingly seeking innovative technologies, such as electric vertical take-off and landing vehicles (eVTOLs), which are designed to transport passengers swiftly across different types of environments—urban, suburban, and rural. eVTOLs are a type of highly automated aircraft that can ascend and descend vertically, making them ideal for densely populated areas where horizontal space is limited. This technology has played a crucial role in the broader fields of Advanced Aerial Mobility (AAM) and Urban Air Mobility (UAM). These terms are often used interchangeably but actually refer to different scales and contexts of aerial transportation. While AAM represents the broader category, with UAM specifically focused on urban applications (Afonso et al., 2021; Cohen & Shaheen, 2021). This distinction highlights the potential of eVTOL technologies to transform transportation infrastructures not just in cities, but across broader regions.

The applications of AAM are wide-ranging. Envisioned as a flexible solution to the current challenges faced by urban and inter-city

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https://doi.org/10.1016/j.trf.2025.02.008
Received 4 August 2024; Received in revised form 5 February 2025; Accepted 5 February 2025
Available online 13 February 2025

travel, AAM has the potential to introduce on-demand air taxi services, which would facilitate swift, point-to-point travel, especially within sprawling mega-city regions. AAM could also provide an alternative for short-distance, inter-city transport niche that traditional aviation methods find logistically challenging and economically unfeasible (Dulia et al., 2021; Goyal et al., 2018). Beyond the urban context, AAM extends the promise of enhanced connectivity to remote rural areas. Here, AAM could serve as facilitating passengers' travel as well as the delivery of goods to underserved locations by current transportation. By doing so, it could offer greater time efficiency and flexibility by taking congested transport networks into the third dimension by integrating new layers of automation, electrification, and connectivity (Chan et al., 2025; Cohen & Shaheen, 2021; Garrow et al., 2021).

Despite the above-mentioned benefits, the integration of AAM into urban environments presents a complex array of potential challenges that could have significant implications for society and individuals alike. A critical concern arises from the embedding of AAM infrastructure, such as take-off and landing platforms, within the existing urban fabric. The establishment of these platforms without careful consideration of urban planning and architectural principles may disrupt city landscapes. There are also concerns about the noise pollution and safety risks associated with increased air traffic in densely populated areas, which could detract from the quality of urban life and raise public health issues. Another concern regarding AAM is the challenge of energy consumption and environmental impact. Current battery technology limits the operational range and payload capacity of eVTOLs, while the energy-intensive process of airlifting – particularly with heavier payloads – raises questions about the overall environmental footprint of this emerging technology (Bacchini & Cestino, 2019). Although AAM aims to create a more efficient transportation system by utilising the currently unused low-altitude air space, its benefits may be disproportionately accessible to wealthier individuals, leaving lower-income communities with limited improvements to their transport options. This disparity risks deepening existing inequalities in urban mobility and could undermine efforts to achieve social sustainability in urban transportation. As such, understanding the views of the general public, particularly how their attitudes, perceived usefulness and trust towards this technology is crucial. By incorporating public perception into the development process, AAM can be better integrated into the current transportation system and contribute to a more advanced and user-centric urban mobility landscape.

Recognising its potential, both established manufacturers such as Boeing and Airbus, and innovative tech companies such as Lilium and Ehang, are racing to develop AAM technology for everyday applications (McKinsey & Company, 2018). Aligning with these advancements, policymakers in China are working to formulate supportive policies and regulations. In 2020, the General Office of the State Council of the People's Republic of China released a circular to accelerate AAM's strategic development within the country (McNabb, 2020). China also introduced a series of measures, such as in the "14th Five-Year Plan for General Aviation Development" in June 2022, outlining the roadmap for AAM's operational development and the development of the "low-altitude economy". This has sparkled rapid AAM development in cities like Shenzhen, Guangzhou, Zhuhai, and Hefei. Recently, companies including Ehang and AutoFlight Technologies have initiated commercial demonstration flights to test AAM's real-world viability (Daleo, 2024).

Given the rapid advancements and regulatory progress in AAM in China a critical next step is to understand public acceptance and user behavioural intentions toward this emerging technology. As AAM is still in its early stages of development, widespread adoption is not yet established, making it difficult to study actual adoption behaviour. Therefore, the objective of this study is to examine the behavioural intention of using AAM among younger generation of residents in Greater Bay Area, China, by combining two widely tested user acceptance models, TPB and TAM and the construct of trust. This study centres on young- and middle-aged adults because their attitudes and behaviours will play a pivotal role in shaping the future adoption of AAM. As AAM move closer to commercial reality, understanding how younger generations perceive, accept, and integrate these innovations into their daily lives becomes increasingly urgent. Their openness to new ideas, their willingness to embrace evolving transportation solutions, and their potential long-term usage patterns can significantly influence market success, ultimately determining how quickly and effectively AAM achieves widespread acceptance.

The contribution of this study is twofold. It firstly focuses on the under-explored domain of AAM acceptance within China's unique socio-cultural context. While a significant body of AAM research centres on the United States and Western Europe (Raghunatha et al., 2023; Vempati et al., 2024), we fill a noticeable gap concerning rapidly urbanising Asian contexts (Meszaros, 2023). Secondly, this study applied multigroup analysis with structural equation modelling to further explore how age and gender differences shape the behavioural intention of adopting AAM. The results highlight the importance of considering demographic-specific factors, attitudes, and trust in designing effective interventions for AAM adoption.

2. Literature review

2.1. Rapid development of advanced aerial mobility (AAM)

Research interest and publications related to advanced aerial mobility (AAM) have proliferated rapidly over the past few years (de Oliveira et al., 2021; Pertz et al., 2023; Pons-Prats et al., 2022; Radic et al., 2024; Vempati et al., 2024). A recent review by Raghunatha et al. (2023) broadly classifies AAM studies into three major categories: primary technology, functionality, and adoption. A substantial body of literature focuses on the technical aspects of AAM, including the development of electric vertical take-off and landing (eVTOL) aircraft, battery technologies, and the integration of autonomous systems for safe and efficient operations (Jin et al., 2024; Mendonca et al., 2022; Wang et al., 2023). However, fewer studies have examined the behavioural and/or socio-cultural aspects of this new technology, including AAM's societal impacts and market acceptance. An earlier assessment by Airbus, which drew upon expert interviews with aircraft manufacturers, government officials, policymakers, and academics, and surveys with users, identified safety, inequity, noise, visual pollution, and privacy as critical factors for public acceptance (Yedavalli & Mooberry, 2019). Straubinger et al. (2020) discussed potential hurdles to the introduction of UAM for intra- and inter-city passenger transport, and identified challenges related to certification, policy, ground infrastructure and traffic management. They have argued that issues regarding infrastructure, regulations, and economic constraints remain unresolved. From a market segment perspective, Samadzad et al. (2024) used stated preference surveys to characterise UAM demand across business, airport access, and tourism purposes, finding that business trips represent the most promising market segment for UAM operations.

In recent years, more studies have begun to explore public acceptance of AAM/UAM. For instance, Kalakou et al. (2023) analysed the attitudes of 485 Lisbon residents toward UAM in urban environments, identifying six clusters of citizens: open-minded, first movers, pollution sensitive, emergency supporters, deniers and skeptics. Similarly, Babetto et al. (2023) surveyed residents of medium-sized European cities, revealing that 59 % hold a moderately positive view on AAM, with 56 % willing to try delivery services and 32 % open to using air taxis – indicating a more cautious stance than those in metropolitan areas.

Other studies have used behavioural models to examine UAM/AAM acceptance. Ariza-Montes et al. (2023), for example, applied technology adoption theories to investigate critical constructs influencing UAM usage intention, using samples from the US and China. Their covariance-based structural equation modeling (CB-SEM) indicates that performance expectancy, attitudes, and social influence reinforces UAM usage intention, and the factor of anxiety reduces it. Likewise, Lee et al. (2023) combined the unified theory of acceptance and use of technology (UTAUT) with the initial trust model, demonstrating that social influence and initial trust are the strongest predictors of the UAM usage intentions. Using the UTAUT2 model, Wu et al. (2024) found that perceived risk is the most influential factor in public acceptance of flying cars, with trust having both direct and indirect effects on future usage intentions.

A more recent study by Karami et al., (2024) investigated UAM usage intention in Tehran, Iran. The structural equation modeling analysis of 828 questionnaires indicates that a range of factors including subjective norms, attitude, trust, perceived enjoyment, perceived usefulness, ecological awareness, personal innovativeness, and price evaluation positively influence UAM usage, while perceived safety negatively affects attitude towards UAM. Likewise, Al Haddad et al.'s (2020) stated-preference survey of 221 European respondents has found that safety, trust, social attitude, affinity to automation and data concerns are significant factors in UAM acceptance, alongside perception of automation costs, value of time savings, and service reliability.

Building on this body of work, this study will integrate the well-tested TAM and TPB theories, along with the construct of trust, to examine behavioural intentions toward AAM in the Chinese context. We will also explore potential differences in AAM acceptance across various socio-demographic groups. The following section will outline the proposed research models, incorporating technical, social, and economic variables to provide a comprehensive framework for this research.

2.2. Theoretical models in technology acceptance and proposed model of this study

To effectively study the adoption of newly developed technologies, it is crucial to employ well-established technology acceptance models. These models, grounded in decades of research and incorporating insights from multiple disciplines, have demonstrated strong predictive power for user intentions and behaviours. The Theory of Planned Behaviour (TPB) (Ajzen, 1991) is a prominent example, which has been widely applied in various technological adoption studies (e.g. Rejali et al., 2023; Luo et al., 2023; Kapser & Abdelrahman, 2020;). For instance, Luo et al. (2023) utilised TPB to understand intentions to use shared autonomous vehicles in Beijing, China, achieving a model fit of 63 %. Similarly, Kaye et al., 2020 used TPB to predict intentions toward conditional automated vehicles, with a model fit of 66 %. In a comparative study, Rejali et al. (2023) found that TPB outperformed both Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) in predicting acceptance of fully automated vehicles, explaining 70.9 % of the variance.

Across these studies, the TPB constructs of attitudes, subjective norms, and perceived behavioural control consistently emerged as significant predictors of behavioural intentions. Since many transport innovations are still under development, research has largely focused on estimating intentions rather than actual usage behaviours. The TPB model provides a robust framework for examining individual intentions toward a specific behaviour through its three core components: attitudes, subjective norms, and perceived behavioural control.

In the context of AAM usage, attitudes reflect an individual's positive or negative evaluation of engaging in AAM usage; subjective norms encompass the perceived social pressure to use or not use AAM, and perceived behavioural control relates to an individual's perception of the ease or difficulty of using AAM. Given the novelty of AAM technology and the potential concerns around safety, noise, privacy, and infrastructure, these components are crucial for obtaining a nuanced understanding of user intentions, as public acceptance and adoption are influenced by multiple psychological and social factors (Armitage & Conner, 2001). Drawing insights from the TPB, the following hypotheses will be tested:

H1. Perceived behavioural control positively influences intention to use AAM.

H2. Subjective norms positively influence intention to use AAM.

H3. Attitude towards AAM positively influences the intention to use AAM.

While sharing Ajzen and Fishbein's (1980) Theory of Reasoned Action as a predecessor with the TPB, the Technology Acceptance Model (TAM) (Davis et al., 1989) has a more specific domain of application for modelling how people accept and use technology. Initially developed by Davis et al. (1989) to explore decisions regarding computer technology use, TAM measures the correlation between the intention to use and actual usage. The model considers two main constructs: perceived usefulness (PU) (the extent to which the user believes that using the technology will enhance their productivity or performance), and perceived ease of use (PEU) (users' expected easiness in using the new technology). In TAM, PEU reinforces PU, and both factors influence attitudes toward using the technology, which then determine the behavioural intention (BI) to use the technology and ultimately, actual usage. Additionally, TAM hypothesises that perceived usefulness mediates the effect of perceived ease of use on attitudes.

Since its inception, TAM has gained widespread popularity for its parsimony, predictive accuracy, and robustness, becoming extensively applied in transportation research. For instance, Xu et al. (2018) used TAM to investigate behavioural intentions towards automated vehicles, finding that TAM constructs, along with trust, explained approximately 55 % of the variance in intentions. Similarly, Wang et al. (2020) extended TAM to examine consumer intentions for ride-sharing services, achieving a model fit of 76 %. In the context of connected vehicles, Acharya and Mekker (2022) demonstrated that perceived usefulness and perceived ease of use positively influenced both attitude and behavioural intention, with a model explaining 81.4 % of the variance.

Although studies applying TAM to study AAM are rare, one notable exception is Johnson et al. (2022). Their study examined public expectations and perceptions of passenger air vehicles through an online survey of U.S. respondents. The results indicated that early adopters have stronger trust in the technology and are willing to pay more to use it, whereas later adopters express greater safety concerns, which hinders their acceptance of urban air mobility services. Given TAM's strong empirical support and predictive power, it remains a valuable tool for understanding technology adoption in the transportation sector. Therefore, the following hypotheses will be tested in the present study:

H4. Perceived usefulness positively influences the intention to use AAM.

H5. Perceived ease of use positively influences attitude towards AAM.

H6. Perceived usefulness positively influences attitude towards AAM.

H7. Perceived ease of use positively influences perceived usefulness.

To examine the adoption of AAM, it is essential to understand the conditions necessary for trusting this technology (AI Haddad et al., 2020). Trust has been identified as crucial in shaping users' perceptions and readiness to embrace novel technologies. It comprises dimensions such as trust in the technology itself, service providers, and the broader ecosystem facilitating the technology. Venkatesh and Davis (2000) investigated user acceptance and adoption of information technology (IT) systems within organizational settings, and delineated how trust indirectly influenced subjective norm, image, and PEU, thereby extending the TAM to the TAM2 model. Trust also emerged as a significant factor affecting performance expectancy and effort expectancy within the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003). Gefen et al. (2003) explored trust in the context of online shopping and found that trust directly influenced PEU and PU, and consequently adoption intentions. Likewise, McKnight et al. (2002) investigated how initial trust forms when users firstly encounter an e-commerce website. Their results highlight the importance of initial trust in the early stages of technology adoption, in terms of influencing users' wiliness to engage in online transactions.

This body of literature also illuminates the understanding of trust in the transportation sector, where safety and reliability are of utmost importance (Adnan et al., 2018; Vance & Malik, 2015). For example, numerous studies have pinpointed trust as a crucial element in promoting a positive attitude towards using autonomous vehicles (AVs), demonstrating that trust directly influences PU and PEU, with PU determining the behavioural intention (Ghazizadeh et al., 2012; Zhang et al., 2020). Choi and Ji (2015) found that trust in technology and manufacturer reputation significantly impacts user acceptance, as the perceived safety and reliability are crucial for building trust in autonomous vehicles. Parkin et al. (2023) specially examined trust in automated vehicles by cyclist and pedestrian. They carried out trials of a simulator AV undertaking three priority-based manoeuvres. Their results indicate that trust scores were closely linked to the re-assurance by the behaviour of the AVs. Paddeu et al. (2020) identified comfort and trust as key influencers of AV acceptance through experimental riding in a Shared Autonomous Vehicle (SAV) shuttle. Their results showed statistically significant relationship between trust and each of their independent variables, positing trust as a critical predictor of perceived comfort.

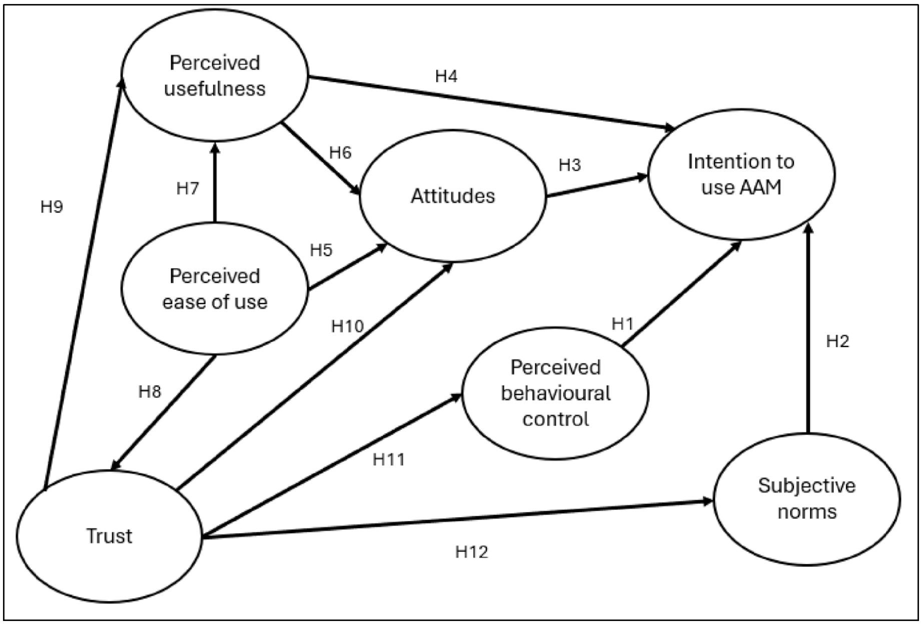


Fig. 1. The proposed model.

Based on existing evidence, our model incorporates initial trust in AAM technology, given that users have yet to interact extensively with AAM service providers or systems (Zhang et al., 2020). It is hypothesised that trust will be a critical component in shaping individual's intention to use AAM in its initial development stage. Potential customers need to develop trust to overcome perceived risk and form positive attitudes towards AAM. Thus, the following hypotheses will be tested, and the proposed model is presented in Fig. 1:

H8. Perceived ease of use positively influences trust.

H9. Trust positively influences perceived usefulness.

H10 Trust positively influences attitude towards AAM.

H11. Trust positively influences perceived behavioural control.

H12 Trust positively influences subjective norms.

In addition to these proposed hypothesis, socio-demographic factors also significantly influence AAM usage intentions. Factors such as gender, age and prior experience with the technology may moderate the effects of PU, PEU and subjective norms on the intention to use the new technology (Sun & Zhang, 2006). Research indicates that men, particularly younger respondents, are more willing to use UAM (Fu et al., 2019; Reiche et al., 2018), thus, we hypothesised that younger participants might have stronger intentions of using AAM. In terms of gender, previous studies have shown that males are more confident in their computer abilities than their female counterparts and exhibit a stronger desire to accept new technologies (Karimi et al., 2024; Vekiri & Chronaki, 2008). As such, it is hypothesised that males might have stronger behavioural intentions to use AAM. Given these previous studies, we hypothesised that there are significant differences in relationships among the TAM and TPB constructs on AAM usage intentions.

3. Methodology

3.1. Survey design and measurement items

This study employed an online survey for data collection. The survey comprised three sections. The first section assessed respondents' general knowledge of AAM, including prior exposure and overall impressions. Questions are asked about whether the respondents have heard about AAM in the past and if yes, what are the sources of their prior experience, such as friends/relatives, magazine, social media, newspaper, television or online advertisement. The second section utilised established constructs from TPB and TAM to measure potential predictors of AAM adoption. Respondents indicated their level of agreement with statements on a 5-point Likert scale (strongly disagree = 1, strongly agree = 5). The measurement items used in the survey are presented in Table 1. The final section collected socio-demographic data, including age, gender, income, education, employment, and car ownership.

Table 1
Items used to measure the constructs in the proposed model.

Constructs	Items	Statements	Sources
Perceived usefulness	PU1	I think AAM would be useful in meeting my transportation needs.	Adapted from Liu et al., 2022; Panagiotopoulos & Dimitrakopoulos, 2018
	PU2	I think using AAM would make it easier to avoid congestion.	
	PU3	I think the use of AAM would reduce my accident risk.	
	PU4	I think AAM would relieve my stress when traveling.	
	PU5	Overall, I find AAM services would be useful to the society in the future.	
	PU6	I foresee that AAM would enhance the mobility of people regardless of their age, skill, and ability.	
Perceived ease of use	PEU1	I think it would be easy to learn to travel by AAM.	Adapted from Panagiotopoulos & Dimitrakopoulos, 2018
	PEU2	My interactions with AAM would be clear and easy to understand.	
	PEU3	I think it would be easy for me to use AAM.	
Attitude towards AAM	ATT1	I think using AAM would be a good idea.	Adapted from Cheng et al., 2019
	ATT2	I think using AAM would be a wise idea.	
	ATT3	I like the idea of AAM.	
Behavioural Intention	BI1	Given the chance, I intend to use AAM services.	Adapted from Liu et al., 2022
	BI2	Given the chance, I predict that I will use AAM services in the future.	
	BI3	I intend on informing my relatives and friends about AAM.	
	BI4	If I had the opportunity, I would try to use AAM regularly.	
Subjective norms	SN1	I would be proud if people saw me using an AAM.	Adapted from Chen and Chao, 2011
	SN2	People whose opinions I value would like to use AAM.	
	SN3	I would be more likely to use AAM if my friends and family members use them.	
	SN4	People who are important to me would want me to use AAM.	
Perceived behavioural control	PBC1	Whether or not I use AAM is completely up to me.	Adapted from Chen and Chao, 2011; Kaye et al., 2020,Rejali et al., 2023
	PBC2	In the future, I believe I have the resources and time to use AAM.	
	PBC3	I am confident that if I want, I can learn and use AAM.	
	PBC4	I have complete control over whether I use AAM.	
Trust	TRU1	I generally think AAM are dependable	Adapted from Zhang et al., 2019; Liu et al., 2022
	TRU2	In general, AAM are reliable	
	TRU3	Overall, I can trust AAM	

3.2. Data collection

A reputable online survey platform in China - Cremado (https://credamo.com) was used to distribute the survey among residents of the Greater Bay Area in Guangdong Province. This region includes Guangzhou, Shenzhen, Foshan, Zhuhai, Zhongshan, Dongguan, Huizhou, Zhaoqing, Jiangmen, and two special administrative regions (SARs), Hong Kong and Macau. Due to significant differences in socio-economic development between the two SARs and the other GBA cities, this study focused solely on GBA cities in Mainland China. Data were collected in November and December 2023.

To ensure language clarity and cultural relevance, the survey was designed in both English and Chinese. Both versions were reviewed by the leading author and two other bilingual speakers whose first language is Mandarin. The survey was also piloted tested by 18 participants before its formal distribution online. Feedback was obtained from the pilot study participants to modify the survey, to ensure it is easily understandable (Chan et al., 2021). Prior to participation, respondents were provided with a brief introduction to AAM and its applications, which emphasised passenger-carrying services to distinguish them from common drone delivery operations. The brief introduction is presented in Appendix 1.

To ensure the quality of the results, several measures were adopted. First, respondents were restricted to one submission per IP (Internet Protocol) address to prevent duplicate entries. Attention-check questions were incorporated throughout the survey, such as "This is a quality control question, please select 'totally agree'." to filter out inattentive participants. Total survey completion times were also tracked. Submissions completed in under 5 min were rejected, given that this may imply insufficient time spent in providing thoughtful responses. These measures aimed to minimise duplicate entries, inattentiveness, and rushed responses, thereby enhancing the validity and reliability of the data. Finally, a small financial incentive (RMB10, equivalent to USD1.4) was offered to encourage participation.

3.3. Participants

Among the 1016 questionnaires, we obtained 988 valid questionnaires after removing those with incomplete answers. The sample profile is shown in Table 2. The sample consists of 30.5 % male and 69.5 % female respondents. Most of the respondents (70.6 %) are aged between 18–30; 83.9 % have a bachelor's degree or higher education level; 41.8 % are car owners, and more than half of our sample resides in the first-tier cities, Guangzhou and Shenzhen.

3.4. Data analysis

Data analysis was conducted using SPSS 26 and AMOS 24. First, descriptive statistics of the participants and major variables were

Table 2
Socio-demographic characteristics of the respondents.

Variables	Number of respondents (n = 988)	Percentage (%)
Gender		
Male	301	30.5
Female	687	69.5
Age		
18–30	698	70.6
31–40	236	23.9
41–50	28	2.8
Over 51	26	2.6
Personal monthly income (CNY)		
Below 3,000	192	19.4
3,001–5,000	157	15.9
5,001–10,000	385	39.0
>10,000	254	25.7
Education level		
Senior high school or below	159	16.1
Bachelor's degree	675	68.3
Master's degree or higher	154	15.6
Car ownership		
Yes	413	41.8
No	575	58.2
City of residence		
Guangzhou	384	38.9
Shenzhen	168	17.0
Dongguan	108	10.9
Foshan	71	7.2
Jiangmen	67	6.8
Zhuhai	55	5.6
Zhongshan	48	4.9
Huizhou	45	4.6
Zhaoqing	42	4.3

presented. Next, the internal consistency of the main scales was assessed using Cronbach's alpha, with a threshold of 0.7 indicating acceptable reliability (Hulin et al., 2001). Structural equation modelling (SEM) was conducted using the maximum likelihood method. Following a two-stage approach (Anderson and Gerbing, 1988), confirmatory factor analysis (CFA) was conducted to evaluate the convergent validity and discriminant validity of the measurement model. Subsequently, we estimated the structural model and tested our research hypotheses. To estimate the direct, indirect, and total effects and the significance level of the model, a bootstrap procedure with 2000 subsamples and a 95 % percentile bootstrap confidence interval were used.

Afterwards, we conducted multigroup analyses to determine if the hypothesised model structure is consistent across different demographic groups, specifically between younger and older adults, and among men and women. These analyses help verify the stability of the model across these groups and identify specific areas where differences may exist within the proposed model. By pinpointing potential discrepancies among groups, we can ascertain which factors hold greater significance for particular user segments. This insight is crucial for developing targeted interventions and communication strategies.

4. Results

4.1. Descriptive statistics

Among all respondents, a significant majority (57.1 %) reported having prior knowledge of AAM. An analysis of the sources from which participants learned about AAM (illustrated in Fig. 2) reveals a striking preference for digital platforms. Specifically, an overwhelming 94.1 % of those who were familiar with AAM had been informed through social media. This percentage starkly contrasts with the reach of other information sources, such as online advertisements and television, which accounted for 53.2 % and 35.6 % respectively. Notably, traditional newspapers were the least cited source, with only 8.5 % of participants acknowledging them as a means of learning about AAM. This data highlights the important role of new media in disseminating information about AAM, suggesting a shift in how technological advancements are communicated to the public.

Furthermore, the survey explored respondents' expectations regarding the timeline of adopting AAM for personal travel. The findings indicate a correlation between familiarity with AAM and optimism about its near-term implementation. Over 40.1 % of those with prior knowledge of AAM anticipate using such modes of transport within the next decade. This figure significantly outpaces the expectations of participants without AAM familiarity, of whom only 25.5 % share this outlook (as depicted in Fig. 3). This optimism among informed individuals highlights the potential for increased awareness and understanding of AAM to accelerate public acceptance and adoption of innovative transportation solutions.

4.2. Measurement model

Confirmatory factor analysis was performed to assess the proposed model. The reliability and convergent validity of measurement items for the model is shown in Table 3. One item of subjective norms ("I would be more likely to use AAM if my friends and family members use them") and one item of perceived usefulness ("I think using AAM would make it easier to avoid congestion") were removed from the CFA, as their factor loadings are less than 0.5, based on the recommendation by Hair et al. (2014). Afterwards, the CFA was re-estimated and the results demonstrate a good fit (CMIN/df = 2.186, CFI = 0.972, GFI = 0.956, NFI = 0.951, and RMSEA = 0.035).

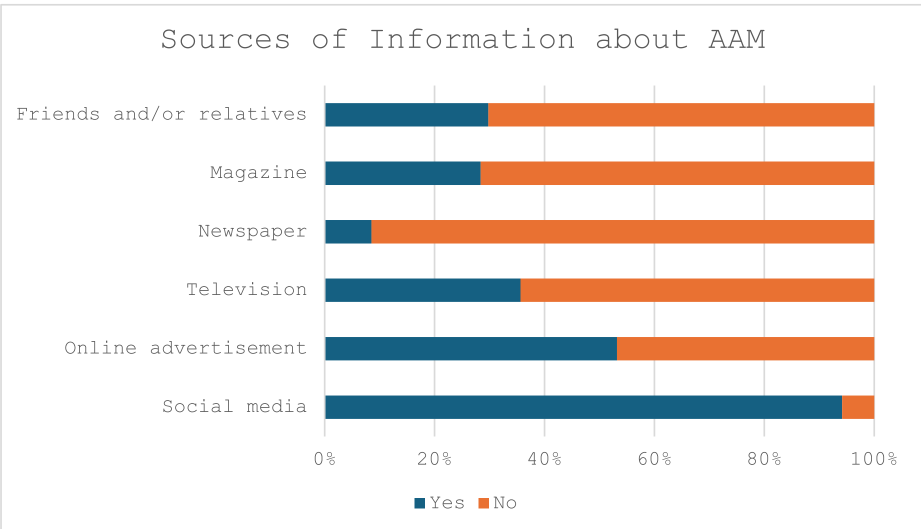


Fig. 2. Sources of Information about AAM.

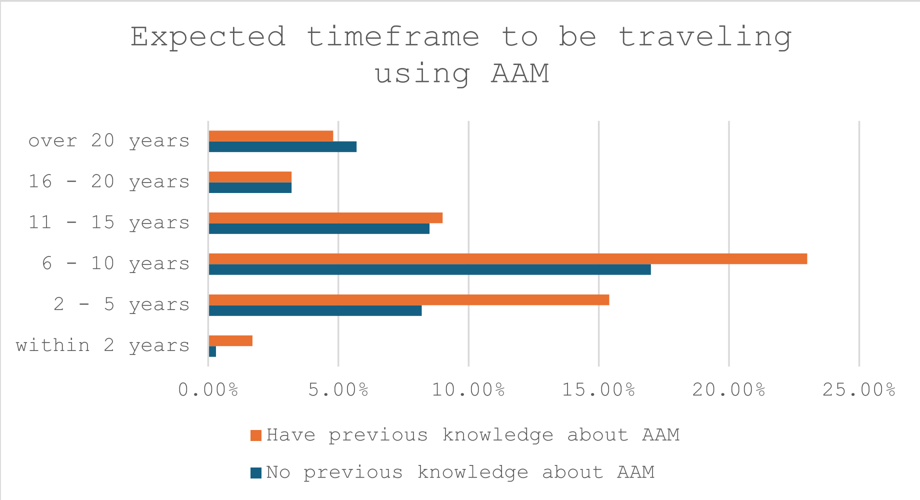


Fig. 3. Comparison of expected timeframe of traveling using AAM.

Table 3
Reliability and convergent validity of measurement items for the proposed model.

Construct	Item	Standardised factor loading	t-value	CR	AVE
Perceived usefulness (PU, α = 0.829)	PU1	0.772	19.512	0.835	0.505
	PU3	0.648	16.994		
	PU4	0.783	19.717		
	PU5	0.694	18.233		
	PU6	0.643	**		
Perceived ease of use (PEU, α = 0.839)	PEU1	0.777	**	0.840	0.636
	PEU2	0.813	25.184		
	PEU3	0.800	24.180		
Attitude towards AAM (ATT, α = 0.766)	AT1	0.739	19.229	0.765	0.521
	AT2	0.749	18.555		
	AT3	0.680	**		
Subjective norms (SN, α = 0.769)	SN1	0.669	19.726	0.774	0.535
	SN2	0.700	19.815		
	SN4	0.818	**		
Perceived behavioural control (PBC, α = 0.815)	PBC1	0.688	20.221	0.816	0.526
	PBC2	0.744	19.763		
	PBC3	0.724	19.471		
	PBC4	0.743	**		
Trust (TRU, α = 0.848)	TRU1	0.806	**	0.849	0.652
	TRU2	0.825	27.406		
	TRU3	0.790	25.751		
Behavioural Intention (BI, α = 0.794)	BI1	0.745	21.533	0.804	0.509
	BI2	0.739	21.457		
	BI3	0.600	17.756		
	BI4	0.757	**		

Note: ** = items constrained for identification purposes.

Table 4
Discriminant validity of the proposed model.

Construct	PU	PEU	SN	ATT	PBC	TRU	BI
Perceived usefulness (PU)	*0.710*						
Perceived ease of use (PEU)	0.490	*0.797*					
Subjective norms (SN)	0.580	0.536	*0.731*				
Attitude towards AAM (ATT)	0.604	0.510	0.589	*0.722*			
Perceived behavioural control (PBC)	0.394	0.556	0.407	0.425	*0.725*		
Trust (TRU)	0.678	0.597	0.586	0.700	0.429	*0.807*	
Behavioural Intention (BI)	0.657	0.516	0.599	0.680	0.456	0.711	*0.713*

Note: The italic values in the diagonal are the square roots of AVE.

The convergent validity of all latent variables was assessed by average variance extracted (AVE), the standardised factor loadings, and composite reliability (CR), as shown in Table 3. The AVEs and CRs of all latent variables exceed the commonly used thresholds (AVE above 0.5; CR above 0.7) as suggested by Henseler et al. (2015) and demonstrated good convergent validity. We applied the Fornell-Larcker Criterion to evaluate discriminant validity, by calculating the square root of AVE (SAVE) and comparing it with the correlations of other constructs in the model. As shown in Table 4, all SAVEs are greater than the bivariate correlations involving the construct, demonstrating good discriminant validity (Fornell & Larcker, 1981).

4.3. Structural model and hypothesis test

After achieving good model fit for the latent variables, we used the structural model to test the proposed hypotheses. Model fit was assessed through various indices: chi-square to degrees of freedom ratio (CMIN/DF), goodness-of-fit index (GFI), comparative fit index (CFI), normed fit index (NFI), and root mean square error of approximation (RMSEA). The results demonstrate a good model fit (Table 5). Fig. 4 presents the standardised path coefficients of the proposed model.

In the structural model, 10 out of the 12 hypotheses were confirmed. For the TPB constructs, perceived behavioural control ($\beta = 0.125$; $p < 0.001$), subjective norms ($\beta = 0.203$; $p < 0.001$), and attitude towards AAM ($\beta = 0.364$; $p < 0.001$) are all positively and significantly ($p < 0.05$) associated with behavioural intention to use AAM. These findings confirm H1, H2, and H3 and supports the TPB and previous studies stating that attitude positively influences behavioural intention (Liu et al., 2022; Yuen et al., 2021).

For the TAM constructs, perceived usefulness ($\beta = 0.293$; $p < 0.001$) is positively associated with intention to use AAM and attitudes ($\beta = 0.128$; $p < 0.015$), confirming H4 and H8. However, perceived ease of use has statistically insignificant effects on attitude towards AAM ($\beta = 0.040$; $p < 0.384$) and perceived usefulness ($\beta = 0.038$; $p < 0.392$), which refutes hypotheses H5 and H7.

Trust has significant positive effects on perceived usefulness ($\beta = 0.695$; $p < 0.001$), attitude towards AAM ($\beta = 0.634$; $p < 0.001$), perceived behavioural control ($\beta = 0.505$; $p < 0.001$), and subjective norms ($\beta = 0.666$; $p < 0.001$). Thus, confirming hypotheses H9, *H*10, *H*11, and H12, respectively. Perceived ease of use also shows significant positive effects on trust ($\beta = 0.651$; $p < 0.001$), confirming H8.

Table 6 shows the standardised direct, indirect and total effects of the variables in the proposed model. The total effect of trust on behavioural intention of using AAM is highest among all variables (0.665), followed by perceived ease of use (0.461), and attitude towards AAM (0.364). Finally, among the constructs of TPB and TAM, TAM constructs have stronger total effects (PEU = 0.461; PU = 0.340) on behavioural intention to use AAM than the TPB constructs (PBC = 0.125; SN = 0.203).

4.4. Multigroup analyses

Multigroup analyses were also conducted to investigate the differences between two groups of participants towards intention of using AAM; distinguished by age and gender. Before conducting the analysis, the configural invariance and metric invariance were checked. The former is to check whether the same factor structure exists between both groups; while the latter ensures that the increase on an observed variable reflects the same change in the underlying latent construct across both groups (Chen et al., 2005). Various fit indices, including CMIN/DF, GFI, CFI, NFI and RMSEA were used to assess the model fit, and for these two models, only NFI for the age model falls slightly below the threshold of 0.9. Overall, these models demonstrate acceptable fit to the data. The results of the model fit are presented in Table 7.

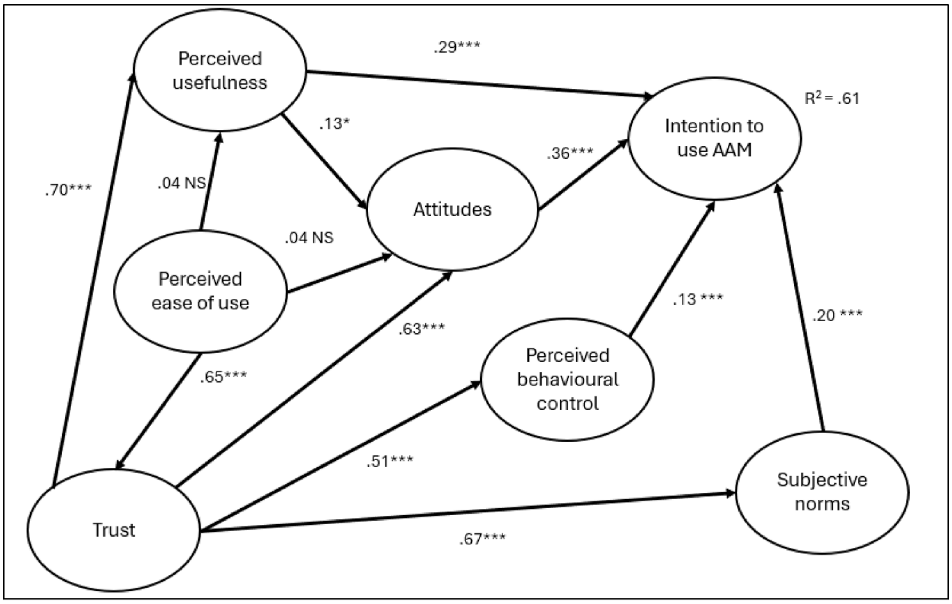
Following past research suggesting possible generational differences in technology adoption, especially for young adults (Owens et al., 2015), we divide participants into young adults (18–30) and mid-to-old adults (over 30). First, comparing the explanatory power of the segmented models, the R^2 for behavioural intention of using AAM for the young adult model is 0.55, which is lower than the mid-to-old adult model (0.73). The structural model is presented in Fig. 5.

The multigroup analysis results (Table 8) identified statistically significant ($p < 0.05$) differences for path coefficients of trust on subjective norms (H12) and subjective norms on behavioural intention (H2). Trust in AAM has a stronger influence on mid-to-old adults' perception of social expectations (subjective norms) ($\beta = 0.797$; $p < 0.002$) compared to young adults ($\beta = 0.580$; $p < 0.001$). However, for mid-to-old adults, those social expectations have a much weaker effect on their intention to use AAM ($\beta = 0.005$; $p = 0.996$), unlike young adults where they hold considerable weight ($\beta = 0.234$; $p < 0.001$). This suggests that while trust is important for both groups, it might play a different role in their decision-making process. For mid-to-old adults, other factors, such as attitude towards AAM, are more influential in determining their intention to use it.

Next, we compare the segmented model by gender, and the results are presented in Fig. 6 and Table 8. Comparing the explanatory power of the segmented models, the R^2 for behavioural intention of using AAM for men is 0.71, which is higher than for women (0.58). Statistically significant ($p < 0.05$) differences can be observed for the path coefficients of subjective norms on behavioural intention (H2) and trust on perceived behavioural control (H11). The multigroup analysis results reveal that female participants rely more on social cues (subjective norms) for AAM adoption ($\beta = 0.243$; $p < 0.001$), whereas the effect for male participants is statistically

Table 5
Fit indices of the structural models.

Model	Chi-square /df	CFI	GFI	NFI	RMSEA
Threshold	Between 1–3	>0.9	>0.9	>0.9	<0.06
Estimates	2.874	0.955	0.940	0.933	0.044



Note: Significant at: ***p<0.001; **p<0.01; *p<0.05; NS = non-significant

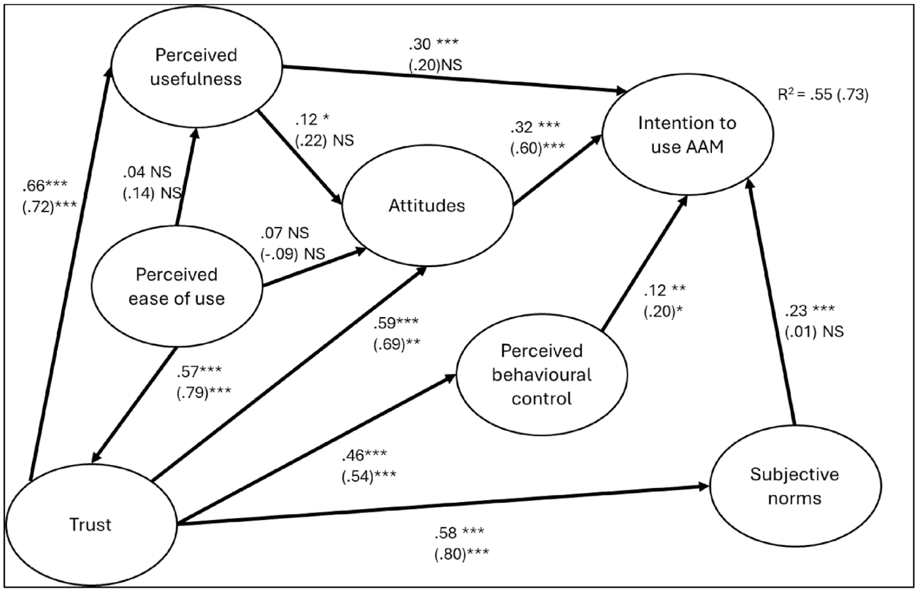
Fig. 4. Results of the structural model.

Table 6
The standardised direct, indirect and total effects of the proposed model.

Paths	Direct effect	P-value	Indirect effect	P-value	Total effect	P-value
PEU → TRU	0.651	0.001			0.651	0.001
PEU → PU	0.038	0.466	0.453	0.001	0.491	0.002
PEU → SN			0.434	0.001	0.434	0.001
PEU → PBC			0.328	0.001	0.328	0.001
PEU → ATT	0.040	0.420	0.476	0.001	0.515	0.001
PEU → BI			0.461	0.001	0.461	0.001
TRU → PU	0.695	0.001			0.695	0.001
TRU → SN	0.666	0.001			0.666	0.001
TRU → PBC	0.505	0.001			0.505	0.001
TRU → ATT	0.634	0.001	0.089	0.078	0.723	0.001
TRU → BI			0.665	0.001	0.665	0.001
PU → ATT	0.128	0.091			0.128	0.091
PU → BI	0.293	0.001	0.047	0.070	0.340	0.001
SN → BI	0.203	0.001			0.203	0.001
PBC → BI	0.125	0.007			0.125	0.007
ATT → BI	0.364	0.001			0.364	0.001

Table 7
Model fit indices for the multigroup analyses models.

Fit indices	Threshold	Estimate of models	
		Age (young vs mid-to-old)	Gender (male vs female)
CMIN/DF	Between 1–3	2.118	1.953
CFI	>0.9	0.939	0.951
GFI	>0.9	0.913	0.918
NFI	>0.9	0.891	0.905
RMSEA	<0.06	0.034	0.031
AIC	n/a	1364.892	1273.653
BIC	n/a	1378.582	1286.354



Note: Significant at: ***p<0.001; **p<0.01; *p<0.05; NS = non-significant (coefficients for mid-to-old adults are place in brackets)

Fig. 5. Results of multigroup analysis in terms of age (young adults vs mid-to-old adults).

Table 8
Multigroup analyses results.

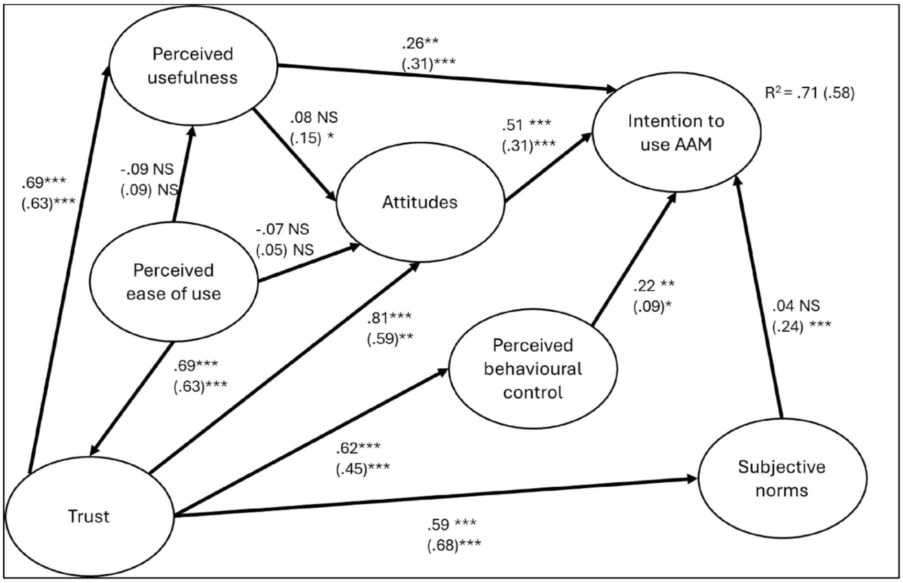
Hypotheses		Path coefficients Young (18–30)	Mid-to-old (>30)	Significant difference (Young vs Mid-to-old)	Path coefficients Male	Female	Significant difference (male vs female)
H1	PBC → BI	0.122	0.194	No	0.216	0.090	No
H2	SN → BI	0.234	0.005	Yes	0.040	0.243	Yes
H3	ATT → BI	0.324	0.600	No	0.512	0.313	No
H4	PU → BI	0.300	0.198	No	0.260	0.309	No
H5	PEU → ATT	0.068	−0.089	No	−0.071	0.049	No
H6	PU → ATT	0.120	0.218	No	0.084	0.146	No
H7	PEU → PU	0.039	0.014	No	−0.089	0.086	No
H8	PEU → TRU	0.570	0.794	No	0.694	0.628	No
H9	TRU → PU	0.659	0.722	No	0.684	0.689	No
H10	TRU → ATT	0.588	0.694	No	0.805	0.591	No
H11	TRU → PBC	0.457	0.540	No	0.618	0.452	Yes
H12	TRU → SN	0.580	0.797	Yes	0.589	0.681	No

insignificant ($\beta = 0.040p = 0.598$). In contrast, the effect of trust on perceived behavioural control is considerably stronger for male participants ($\beta = 0.618$; $p < 0.001$) compared to female participants ($\beta = 0.452$; $p < 0.001$). This suggests that gender plays a role in the decision-making process for AAM adoption. Female participants prioritise social influence, while male participants place a greater emphasis on their own sense of control over their behavioural intention of using AAM.

5. Discussion

The transportation landscape is undergoing rapid transformation driven by innovative technologies and new mobility options. Among these, AAM holds the potential to revolutionise both individual travel experiences and broader societal transportation systems. However, research on travellers' intention to utilise AAM has been growing rapidly in the past few years, although most of these studies have been focusing on western cities. Studies on the development of AAM in China is scarce. This study aims to address this gap by examining factors influencing AAM usage intention by combining two established models: the Theory of Planned Behaviour (TPB) and Technology Acceptance Model (TAM), together with the construct of trust. We contribute to a relatively limited body of research by providing a nuanced understanding of AAM's potential within the unique Chinese context.

The structural equation model results highlight a few key insights: First, in line with the TPB and TAM, attitude is important in shaping individuals' intention to use AAM. As predicted by the TAM model, positive cognitive beliefs, such as perceived usefulness and ease of use, significantly influence on attitude towards AAM. Similar to other studies, attitudes appeared to be the most influential



Note: Significant at: ***p<0.001; **p<0.01; *p<0.05; NS = non-significant (coefficients for female are place in brackets)

Fig. 6. Results of multigroup analysis in terms of gender (male vs female).

factor in shaping individuals' intentions to adopt new transport technologies (Kaye et al., 2020). These positive attitudes, in turn, contribute to the intention to use AAM. For example, if consumers form a favourable impression of AAM, they will be more inclined to choose AAM's services when they are given the option in the future. In addition, TAM constructs (PEU and PU) demonstrated stronger total effects on behavioural intention to use AAM compared to the TPB constructs (PBC and SN). While direct comparison of these two models is beyond the scope of this paper, the results indicated that in predicting usage intention of new technologies, the TAM might be more useful than the TPB. But more detailed comparison is invited in future studies to understand the explanatory power of these different modes in predicting AAM usage intention. Furthermore, the multigroup analyses revealed consistent effects of attitudes on behavioural intention across gender and age groups. This aligns with existing research on transport technology acceptance, emphasising the critical role of attitudes in forming intentions to use new technologies (Al Haddad et al., 2020; Kaye et al., 2020a; 2020b). In recognition of the importance of attitudes, addressing concerns surrounding the operation of AAM (e.g. safety, noise, privacy, and accessibility) will be crucial to improve the public's intention to use AAM. Early public engagement through transparent communication and education about AAM's benefits and safety measures can help to improve the public's attitude regarding on AAM and pave the way for broader acceptance (Buckley et al., 2018; Panagiotopoulos & Dimitrakopoulos, 2018).

Trust has emerged as the most influential factor predicting the intention to use AAM, which is beyond our expectations. Initially, our study design only incorporated a general sense of initial trust to the AAM system, rather than examining more specific aspects of trust. The focus on initial trust is particularly pertinent given that, unlike established technologies where user experience often drives adoption, people's lack of prior exposure to AAM and the absence of a broader societal discourse create an environment where trust becomes paramount (Zhang et al., 2020). The primacy of trust may stem from the inherent uncertainties and perceived risks associated with AAM, as discussed in other studies (Wu et al., 2024). Without a foundation of trust in AAM's effectiveness and safety, potential users are unlikely to overcome their hesitations and embrace this technology. Furthermore, the limited discussion on AAM creates an information gap, leaving individuals without a strong basis to assess AAM's value and benefits. Thus, building trust is essential in bridging this gap, allowing users to gain confidence in AAM's potential. Therefore, fostering trust should be the initial focus for promoting AAM adoption at this stage. However, as AAM continues to evolve, future research should aim to further disintegrate different dimensions of trust, such as trust in technology itself, trust in service providers, and trust in the overall ecosystem; and examine their respective impacts on AAM acceptance (Huijts et al., 2012).

Some unexpected results have been found. The results reveal that perceived ease of use does not exert a statistically significant influence on either perceived usefulness or attitudes. This finding contrasts with prior research, which has generally reported positive relationships between perceived ease of use and both perceived usefulness and attitudes (Herrenkind et al., 2019). One possible explanation is that, when potential users are unfamiliar with a new technology, trust may supersede attitudinal or functional considerations (such as perceived ease of use and perceived usefulness) in shaping their behavioural intentions (Dirsehan & Can, 2020; Zhang et al., 2020).

The multigroup analyses revealed clear age-related differences in the factors influencing behavioural intention to use AAM. Perceived usefulness and subjective norms (perceived social pressure to use AAM) were significant predictors of young adults' intention of using AAM. This suggests that emphasizing the social acceptance and potential to feel pride associated with AAM use could be an effective strategy for this demographic (Jing et al., 2020). For mid-to-old adults, attitudes, likely reflecting a focus on risk–benefit analysis, emerged as a more important driver of intention. Therefore, communication efforts targeting this group should prioritise clear explanations of the potential benefits and risks of AAM services to help them form positive overall value judgments (attitudes) before considering AAM adoption.

Gender differences can also be observed through the multigroup analysis. We found that perceived behavioural control is important in shaping intention to use AAM for men, but not for women. On the contrary, subjective norms are significant and positively associated with behavioural intention for females but not for males. This finding aligns with some previous work that shows weak effects of social influence on male's acceptance of new technologies (Kapser et al., 2021; Kyriakidis et al., 2015). Emphasis on subjective norms, such as testimonials from other women who have successfully used AAM, peer endorsements, and social media campaigns featuring positive female role models using AAM, can be potentially effective strategies to increase women's acceptance of AAM. For men, highlighting the functional aspects of AAM and how it can empower them to solve specific problems or complete tasks efficiently could resonate well with this demographic. Addressing any potential concerns men might have about privacy, security, or the learning curve associated with AAM adoption could also be crucial in fostering trust and encouraging them to explore this technology.

In terms of explanatory power, the proposed model explains about 61 % of the total variation in behavioural intention of using AAM, which is comparable to previous studies on the acceptance of other transportation technologies, like autonomous vehicles and ride-sharing (Wang et al., 2020; Xu et al., 2018; Yao et al., 2023; Zhang et al., 2020). Nonetheless, future studies can further expand the proposed model by incorporating other potentially important factors that might shape the intention in using AAM.

6. Conclusion

The limitations of this study should be acknowledged. Firstly, AAM's novelty and limited real-world application restrict our ability to assess AAM users' actual usage behaviour. As a result, it is impossible to estimate the actual behaviour in using AAM, and we have to necessarily limit ourselves to analysing behavioural intentions instead. However, to what extent intention can be converted into actual AAM usage behaviour is largely unclear and deserve further investigation when this technology becomes more accessible. Next, we tested the proposed model that combines the constructs of TPB and TAM with addition of the concept of trust. To further examine the factors that shape behavioural intention of AAM, researchers can draw insights from various behavioural and psychological theories to include other factors worth studying, such as perceived safety, perceived enjoyment, habit, reliability, and travellers' price evaluation of AAM services. Thirdly, the study relies on initial intentions formed through information gathered from diverse sources like the internet and media. As AAM adoption progresses, individuals' experiences and evolving understandings will likely impact their behavioural intentions and their underlying determinants. A longitudinal study could provide valuable insights into how these intentions evolve with increased exposure to AAM technology. Moreover, the focus on psychological factors may not fully capture the complex interplay of social, economic, and technological factors that will shape AAM's future. For instance, issues such as noise pollution, privacy concerns, and equitable access to AAM services have not been extensively explored in this study. Future research should explore these areas to provide a more comprehensive understanding of the potential impacts of AAM. Finally, the online survey method employed in this study has resulted in potential bias of the sample towards young, female and well-educated individuals. Future efforts could benefit from incorporating alternative sampling methods, like quota sampling and proportional sampling, and combining other survey distribution methods, such as street-intercept survey to ensure broader representation of the population, encompassing the elderly, less educated, and unemployed individuals.

Overall, this study highlights the significant influence of both attitudes toward AAM and trust on the intention to adopt AAM services. For operators and service providers, employing effective communication strategies is crucial for addressing user concerns and cultivating favourable perceptions among diverse demographic groups. By tailoring messages according to characteristics such as age and gender, these strategies can become more relevant and persuasive. Recognising the key factors that shape public opinion enables policymakers and industry leaders to support the responsible and equitable progression of AAM for the collective benefit of society. Ultimately, it is through reciprocal communication efforts that AAM stakeholders and the wider public can engage with, respond to, and decide whether to accept or reject this emerging transportation innovation.

CRediT authorship contribution statement

Eric T.H. Chan: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing - original draft, Writing - review & editing. **Tingting Elle Li:** Conceptualization, Data curation, Formal analysis, Methodology, Writing - original draft, Writing - review & editing. **Tim Schwanen:** Methodology, Writing - original draft, Writing - review & editing.

Funding

This work was supported by the Faculty Research Grant [GSFG/22/13] and Direct Grant [DR24E2] from Lingnan University.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

The authors wish to express our gratitude to the handling editors, Prof. Patricia Delhomme and Professor Carlo Prato, as well as the other anonymous reviewers who were so patient and provide many constructive comments to this paper. This work will never have its current shape without your contributions.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.trf.2025.02.008.

Data availability

The authors do not have permission to share data.

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