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The role of technology belief, perceived risk and initial trust in users' acceptance of urban air mobility: An empirical case in China

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ABSTRACT

Urban Air Mobility (UAM) is poised to revolutionize transportation, necessitating an assessment of public acceptance before broad commercial adoption. This study presents the Urban Air Mobility Acceptance Model (UAM-AM), which draws from the Technology Acceptance Model (TAM) and underscores the crucial role of initial trust, technology belief and perceived risk. The UAM-AM is validated using Structural Equation Modeling (SEM) based on 544 questionnaires for the first time in China. The findings highlight the significant impact of perceived ease of use and perceived usefulness on acceptance, uncovering a complex interplay with the intention to utilize UAM services. Notably, initial trust emerges as a foundational factor, influencing attitudes directly or indirectly through perceived ease of use and perceived usefulness. Moreover, the research identifies technology belief and perceived risk as fundamental drivers of initial trust. Examination of demographic segments reveals a heightened technology belief among individuals with backgrounds in science, indicative of a more favorable attitude towards UAM adoption. In closing, the paper presents recommendations for policymakers, service providers, and eVTOL manufacturers to formulate effective strategies that promote public acceptance during the initial phases of UAM deployment.

1. Introduction

Recently, advancements in electrification and automation have paved the way for the emergence of urban air mobility (UAM). As a revolutionary transportation mode, it aims to create an affordable, sustainable, and safe air transportation system for intra-city mobility (Cohen et al., 2021). By transcending the limitations of traditional two-dimensional transportation and reducing the dependence on heavy ground-based infrastructure like roads, rail, and bridges, UAM has the potential to transform urban transportation by providing fast, efficient, and cost-effective alternatives. The benefits of UAM include reduced traffic congestion (Pukhova et al., 2021), increased mobility (Rothfeld et al., 2021), optimized urban space (Ahmed et al., 2021), and reduced emissions (Cho and Kim, 2022; Zhao et al., 2022), among other benefits. As a result, UAM has gained significant attention from both industry and academia, leading to a substantial increase in related research (Garrow et al., 2021).

While the concept of UAM has been around since the 1960s, it initially involved a few operators using helicopters for point-to-point travel within cities in the USA. However, these early efforts were eventually discontinued due to financial challenges, fatal accidents, and community acceptance issues (Wu and Zhang, 2021). The concept resurfaced with the introduction of electric vertical take-off and landing aircraft (eVTOL) highlighted in the Uber Elevate white paper titled "On-demand Urban Air Transportation"

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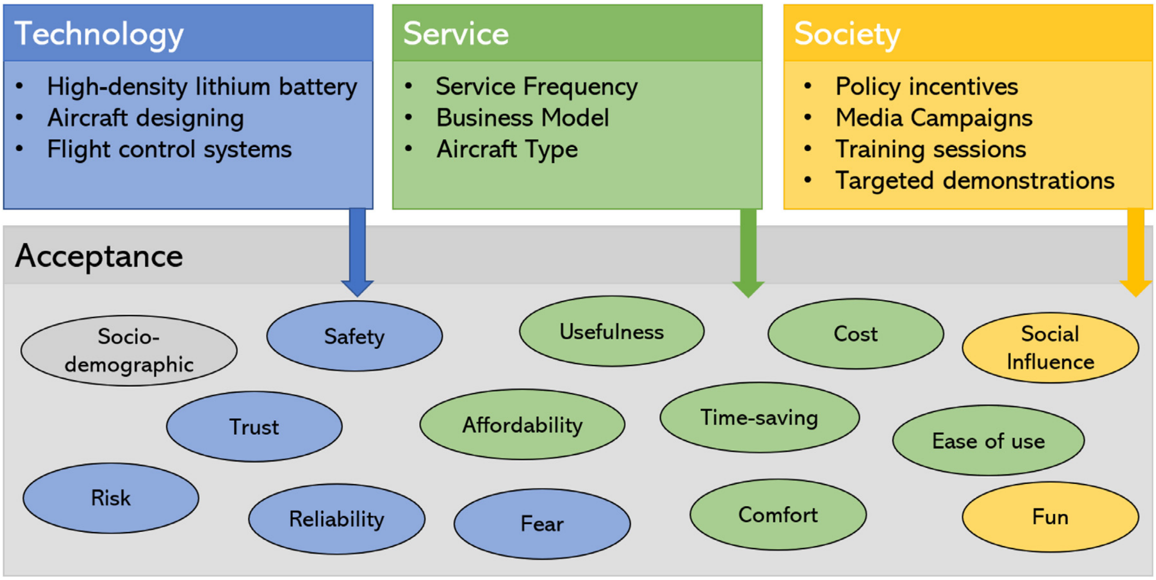

Fig. 1. Factors influencing users' acceptance of UAM.

(Uber, 2016). As a supporter and advocate of UAM, the National Aeronautics and Space Administration (NASA) considers UAM as a part of Advanced Air Mobility (AAM) with excellent market prospects worldwide (NASA, 2020). According to Cohen et al. (2021), the UAM market in the USA is projected to reach $74 billion by 2035, thanks to its well-developed and experienced air transport systems. A recent report by Morgan Stanley's consultancy also predicts that China will be the second-largest market for UAM after the USA, with these two countries accounting for more than half of the global market, which aims to reach close to $5 trillion by 2050. The potential market for eVTOLs has driven manufacturers to develop these vehicles, with some companies expecting them to be available between 2020 and 2025 (Eker et al., 2020). Notably, well-known manufacturers like Joby Aviation, Airbus, Ehang, Lilium, Volocopter, and others have successfully developed and tested various eVTOL prototypes.

Despite the promising future and significant achievements of UAM, several obstacles impede its development, with public acceptance being the primary challenge (Garrow et al., 2021; Pons-Prats et al., 2022; Rajendran and Srinivas, 2020). Users' acceptance is crucial for the sustainability of any new technology, as evidenced by the failure of UAM in the 1960s. Advancing UAM necessitates significant investments in financial and human resources for the development of associated technologies and infrastructure. However, public acceptance of UAM is essential to fully realize its potential economic, social, and environmental benefits. Failure to garner widespread acceptance may hinder the realization of these benefits, rendering investments ineffective. Recent research reveals that public acceptance of UAM is less positive than anticipated, with significant polarization regarding its adoption (Koo et al., 2022). A pioneering survey conducted in Germany indicates that only 22% of respondents are interested in adopting UAM in its first year of operation (Al Haddad et al., 2020). Additionally, respondents do not perceive commuting with UAM as an achievable near-term scenario (Fu et al., 2019). A broader online survey indicates that UAM acceptance varies across different regions and cities worldwide (Pavan Yedavalli, 2019). Residents of Mexico City, in particular, express great enthusiasm for using UAM (67%), while respondents from New Zealand, Switzerland, and Los Angeles show significantly less interest, with only 27%, 32%, and 46% respectively, willing to use UAM. Apart from user perspectives, Desai et al. (2021) collected 51 expert opinions from investors, policymakers, consultants, researchers, and others. Among the 18 issues raised, community acceptance emerged as the primary concern. Consequently, UAM stakeholders and developers should prioritize users' acceptance.

To foster greater public acceptance of UAM, it is crucial to identify the key factors that significantly influence public perceptions. However, previous attempts to examine this issue have been limited within the past five years. This paper summarizes that factors influencing public acceptance of UAM come from three objective aspects: technology, service, and society, as shown in Fig. 1. The successful application of UAM relies on the developed eVTOLs, necessitating advancements in associated technologies such as flight control systems, aircraft design, and high-density lithium batteries.

The performance of these technologies influences users' perceptions of reliability, resilience, safety, and risk (Kim et al., 2022; Yavas, 2023). Unlike cars, eVTOLs are unlikely to be owned by individuals for personal travel, The making UAM highly likely to emerge as a service, termed UAM as a Service (UAMaaS). Factors related to service quality, similar to those in public transportation, are crucial for public acceptance. Cost is one of the most analyzed factors, as high costs may deter potential users. An experiment conducted in Switzerland demonstrated that very few customers would use UAM services if variable costs exceeded 1.8 CHF per kilometer (Balac et al., 2019). Additionally, significant time savings and increased productivity associated with UAM could be key factors in consumer adoption (Kasliwal et al., 2019). Moreover, the discussion of operation modes, namely door-to-door or station-to-station, is relevant. The access and egress processes involved in the latter mode could significantly reduce time-saving benefits and users' willingness to use UAM. Furthermore, users make decisions based on continuous interactions with others in real or virtual societies, including friends, colleagues, family members, or even strangers, and accept their advice to some degree (Boto-García and Baños-Pino, 2022; Zhang et al., 2020). Similarly, users' acceptance of UAM would follow the same pattern. Overall, external factors related to technology, service, and society can influence psychological factors, ultimately affecting users' acceptance.

UAM is a revolutionary and emerging transport technology, but studies on users' acceptance are generally limited. Discussions on the relationship between psychological factors and users' acceptance of UAM are particularly sparse. For example, Kim et al. (2022) have explored the impact of trust and service quality on UAM users' acceptance. While these studies offer important insights, more meaningful factors and mechanisms of users' acceptance remain unexplored. Questions such as how users' trust in UAM is formed and whether acceptance varies among different demographic groups deserve further analysis. Moreover, most research has been conducted in developed countries in Europe and North America, leading to a relative lack of empirical studies in developing countries. The acceptance of emerging technology like UAM varies significantly across regions and is closely tied to the culture, habits, and beliefs of local residents. Civil aviation is more developed in industrialized nations, where residents have higher incomes and more air travel experience. Conversely, the situation in developing countries is different. China, as one of the largest potential markets globally, necessitates empirical research on UAM users' acceptance to gain a comprehensive understanding of potential demand.

This study offers detailed insights into the critical issues surrounding public acceptance of UAM and proposes a novel Urban Air Mobility Acceptance Model (UAM-AM). The model extends the well-established Technology Acceptance Model (TAM) to address previously identified gaps in understanding users' acceptance and intentions. A new construct, technology belief, is introduced to evaluate its significance for the first time. The study collected 544 valid questionnaires in China and employed a Structural Equation Model (SEM) to validate the proposed UAM-AM. This analysis identified the causal relationships between latent variables in the structural model and behavioral intention. The main contributions of this study are summarized as follows. First, we developed a framework based on the original TAM to explore the acceptance of UAM. We extended initial trust, perceived risk, and technology belief to reveal factors influencing UAM acceptance for the first time, offering a more comprehensive understanding of user acceptance in this context. Second, to the best of the authors' knowledge, this research is the first empirical investigation into users' acceptance of UAM in China. It analyzed the differences in UAM acceptance and technology belief among groups with different social attributes, particularly focusing on professional backgrounds such as science and liberal arts groups in China. Lastly, the findings of this study will benefit eVTOL developers, UAM service providers, and policymakers. These stakeholders can provide higher-quality products and services, thereby promoting user acceptance of UAM and gaining competitive advantages in the Chinese and global markets.

The remainder of this paper is organized as follows: Section 2 reviews TAM-related studies in emerging transport technologies and presents the research hypotheses. Section 3 describes the data collected via the questionnaire. Section 4 presents and discusses the empirical results. Section 5 highlights the key theoretical and practical implications, as well as limitations for future research. Finally, Section 6 provides the concluding remarks.

2. Theoretical framework and research hypotheses

2.1. TAM in emerging transport technologies

The Technology Acceptance Model (TAM), introduced by Davis (1989), was the first framework designed to investigate users' acceptance of information systems. Its primary contribution is the provision of a novel framework for modeling technology acceptance by identifying key factors that influence users' decisions to adopt technology. Extensive empirical research has demonstrated TAM's effectiveness in assessing new technology acceptance during its developmental stages. Generally, users' acceptance of new technology is shaped by their beliefs and perceptions, with their intention to use the technology significantly impacting their actual behavior (Venkatesh et al., 2007). The TAM framework includes four key constructs: perceived ease of use (PEU), perceived usefulness (PU), attitude towards using (ATU), and behavioral intention (BI) to use (Davis, 1989). PU refers to the extent to which users believe that a technology will facilitate task performance, while PEU reflects the perceived effort required to use the technology. PU and PEU are primary determinants of ATU, which, in turn, affects BI and the actual usage of the technology. Fig. 2 illustrates the framework and the relationships between these constructs.

With its exceptional interpretability and applicability, the TAM has been extensively utilized to investigate key factors influencing public acceptance of various emerging transportation technologies and services. These include electric vehicles (EVs) (Huang et al., 2021; Jaiswal et al., 2021; Vafaei-Zadeh et al., 2022; Wang et al., 2022; 2018; Wu et al., 2019), autonomous vehicles (AVs) (Ackaah et al., 2022; Choi and Ji, 2015; Dai et al., 2021; Jászberényi et al., 2022; Man et al., 2020; Xu et al., 2018; Yuen et al., 2021a; Zhang et al., 2019; 2020), connected vehicles (CVs) (Acharya, 2022), bike-sharing (Chen and Lu, 2016), e-scooter sharing (Eccarius and Lu, 2020), ride-sharing services (Wang et al., 2020), and others. While UAM is not the first disruptive technology in transportation, it shares several characteristics with EVs and AVs. Previous research has extended the TAM model to gain a deeper understanding of public attitudes and acceptance towards EVs and AVs, as summarized in Table 1. These studies provide valuable insights that can significantly contribute to UAM research.

These studies typically retain the four fundamental constructs of the original TAM: Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude towards Using (ATU), and Behavioral Intention (BI). While researchers have examined various transport technologies, numerous studies have demonstrated positive relationships between PEU and PU and their effects on ATU and BI, along

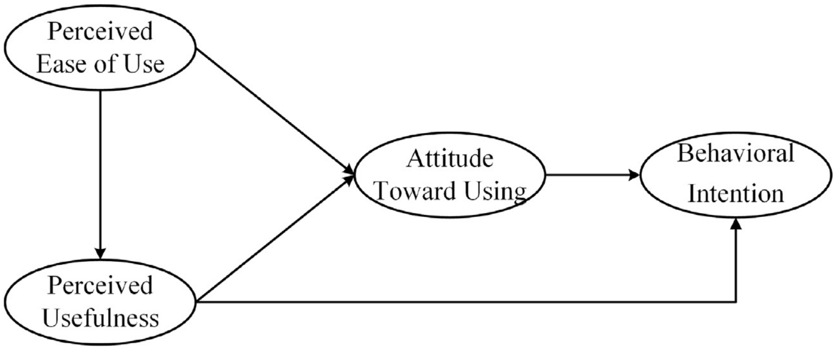

Fig. 2. Original TAM proposed by Davis (1989).

Table 1
Summary of TAM-based related studies on emerging transport technologies.

Authors	Technology	Basic constructs	Extended variables	Sample size	Regions
Wang et al. (2018)	EVs	ATU, PEU, PU, BI	PR, TK, FIP	320	China
Wu et al. (2019)	EVs	PEU, PU, BI	EC	470	China
Jaiswal et al. (2021)	EVs	ATU, PEU, PU, BI	SN, PR	418	India
Huang et al. (2021)	EVs	PEU, PU, BI	PF, TK	443	China
Wang et al. (2022)	EVs	ATU, PEU, PU, BI	PR, SV, IT, SI	426	China
Vafaei-Zadeh et al. (2022)	EVs	ATU, PEU, PU, BI	PR	213	Malaysia
Adu-Gyamfi et al. (2022)	EVs	ATU, PU, BI	PR, SN, TK	405	China
Choi and Ji (2015)	AVs	PEU, PU, BI	PR, Trust, PT	552	Korea
Xu et al. (2018)	AVs	PEU, PU, BI	PS, Trust	300	China
Panagiotopoulos and Dimitrakopoulos (2018)	AVs	PEU, PU, BI	Trust, SI	483	Greece
Zhang et al. (2019)	AVs	ATU, PEU, PU, BI	PR, IT	216	China
Man et al. (2020)	AVs	ATU, PEU, PU, BI	Trust, PR, SQ, CO	237	Hong Kong, China
Zhang et al. (2020)	AVs	ATU, PEU, PU, BI	SI, IT, PT	647	China
Dirsehan and Can (2020)	AVs	PEU, PU, BI	Trust, SC	391	Turkey
Zhu et al. (2020)	AVs	PEU, PU, BI	MM, SM, SE	355	China
Dai et al. (2021)	AVs	ATU, PEU, PU, CUI	SS, CS, PO	383	China
Yuen et al. (2021a)	AVs	PEU, PU, BI	CO	274	China
Ackaah et al. (2022)	AVs	ATU, PEU, PU, BI	Trust, PR, PB, SN, AW	417	Ghana
Jászberényi et al. (2022)	AVs	PEU, PU, BI	OTU, UNS, ACU	646	Hungary
Kim et al. (2022)	UAM	ATU, PEU, PU, BI	Trust, SQ	450	Korea
Yavas (2023)	UAM	PU, BI	IF, UA, UCI, EC, GR	348	Turkey
This paper (2024)	UAM	ATU, PEU, PU, BI	PR, IT, TB	544	China

BI: Behavioral Intention; TK: Technology Knowledge; IT: Initial Trust; ATU: Attitude Towards Using; CUI: Continuous Use Intention; PEU: Perceived Ease of Use; PR: Perceived Risk; PU: Perceived Usefulness; PF: Perceived Fun; FIP: Financial incentive policy; PT: Personal Traits; PS: Perceived Safety; SV: Social value; SQ: System Quality; SS: Service Satisfaction; CS: Concern for the equality of Safety; PO: Psychological Ownership; SC: Stainability Concerns; CO: Compatibility; SQ: Service Quality; SN: Subjective Norm: PB: Perceived Benefits; OTU: Openness to Tourism Usage; UNS: Unusual Surrounding; ACU: Adherence to Conventional Use; MM: Mass Media; SM: Social Media; SE: Self-Efficacy; EC: Environmental Concern; IF: Intention to fly; AF: Affordability; CI: Conceptual Intention; GR: General Reliability.

with a consistent connection between ATU and BI. Consequently, some studies have considered these constructs as a unified construct (Choi and Ji, 2015; Dirsehan and Can, 2020; Huang et al., 2021; Jászberényi et al., 2022; Panagiotopoulos and Dimitrakopoulos, 2018; Wu et al., 2019; Xu et al., 2018; Yuen et al., 2021a; Zhu et al., 2020). Additionally, numerous previous studies have proposed extended variables to account for the unique characteristics of emerging technologies. Among these constructs, perceived risk and trust (or initial trust) have been frequently discussed (Acharya, 2022; Choi and Ji, 2015; Man et al., 2020; Wang et al., 2022; Xu et al., 2018; Zhang et al., 2019; 2020). Perceived risk refers to the possibility of users experiencing unexpected outcomes when using a new transportation technology or service, which may result in dissatisfaction. In contrast, trust is identified as judgments regarding the likelihood of a technology facilitating users' goals in situations of vulnerability and uncertainty (Lee and See, 2004). When examining users' acceptance of AVs, Zhang et al. (2019) emphasized that trust should be more precisely defined as initial trust, since most consumers have no prior experience with AVs.

However, the relationship between initial trust, perceived risk, and other fundamental constructs remains unclear and controversial. For example, Choi and Ji (2015) demonstrated that trust has a negative influence on perceived risk, while Zhang et al. (2019) found that perceived safety risk and perceived privacy risk both have a negative effect on initial trust. Wang et al. (2022) even assumed that there is no relationship between them. Furthermore, little research has delved into the formation of initial trust, which lies between users' beliefs and intentions to use the technology. In addition to perceived risk and trust, some studies have extended variables to reflect users' beliefs, such as subjective norms and personal traits (Wang et al., 2022; Zhang et al., 2020). Building on previous research on EVs and AVs, this paper proposes the following research model and hypotheses.

2.2. Research model and hypotheses

2.2.1. Attitude and behavioral intention

Within the context of technology acceptance, scholars have asserted that BI and ATU are critical psychological constructs in understanding individuals' acceptance of new technologies. BI represents an individual's willingness to use technology, while ATU denotes an individual's positive or negative evaluation of the technology. The original TAM postulates that an individual's attitude towards a technology positively influences their BI to accept and use it. The relationship between BI and ATU is often regarded as the most stable one (Yousafzai et al., 2007). When an individual exhibits a favorable attitude towards using a technology, their BI to adopt it increases, and vice versa. Numerous studies in the transportation field have revealed that users are inclined to use a new technology when they have a positive attitude towards it (Wang et al., 2022; Zhang et al., 2019; 2020). Further supporting this notion, Ajzen and Cote (2008) suggests that an individual's attitude towards a technology is the strongest predictor of their intention to use it. This relationship between attitude and intention has been consistently observed in studies exploring technology adoption (Liu et al., 2018; Park and Ohm, 2014). Overall, the significance of attitude in technology adoption cannot be overstated, as it is a critical factor in determining individuals' BI to adopt and use new technologies. Given the extensive examination of the relationship between attitude towards a specific technology and BI to use that technology in prior studies, the following hypothesis is proposed:

H1: Attitude towards using UAM has a positive impact on behavioral intention to use it.

2.2.2. Perceived usefulness and perceived ease of use

The TAM identifies the factors that influence an individual's willingness to adopt novel technology. The original TAM highlights two key determinants: perceived ease of use (PEU) and perceived usefulness (PU) (Davis, 1989). PEU refers to the extent to which users believe they can learn and use new technology with ease. When a technology is perceived as easy to learn and use, users are more likely to adopt it. Conversely, perceived usefulness pertains to whether users consider the new technology useful and beneficial. perceived usefulness reflects the degree to which users believe that leveraging the technology will enhance their performance, efficiency, or effectiveness (Wang et al., 2022; Zhang et al., 2020). When users perceive a technology as both useful and easy to use, they are more likely to adopt it and maintain a positive attitude towards it. Together, perceived ease of use and perceived usefulness provide a comprehensive framework for understanding users' attitudes towards new technology and their intention to adopt it. Within the context of UAM, it is widely acknowledged that UAM has the potential to generate substantial benefits for consumers and society, including reduced traffic congestion, increased mobility, and decreased energy consumption. These benefits may foster positive attitudes towards UAM usage. Therefore, it is reasonable to assume that consumers who perceive UAM as both useful and easy to use are more likely to maintain a positive attitude towards it and intend to adopt it. Consequently, this paper aims to establish the following hypotheses:

H2a: Perceived usefulness has a positive effect on behavioral intention to use UAM.
H2b: Perceived usefulness has a positive effect on attitude towards using UAM.
H3a: Perceived ease of use has a positive effect on perceived usefulness.
H3b: Perceived ease of use has a positive effect on attitude towards using UAM.

2.2.3. Initial trust

Trust is a multifaceted concept that has been extensively studied across various fields. Initially, it was conceptualized in an interpersonal context, where the trust recipient was another person. Lee and See (2004) defined trust as *'the attitude that an agent will help achieve an individual's goals in a situation characterized by uncertainty and vulnerability'*. However, trust has now expanded beyond interpersonal relationships to include partnerships between humans and technology or automation (Chiou and Lee, 2023; Hoff and Bashir, 2015), with automation being considered a form of technology. Trust has become increasingly relevant in the context of human-technology interactions as humans rely more heavily on machines to perform various tasks, underscoring the crucial role of trust in these interactions. Trust in technology reflects an individual's belief that technology will perform as intended and yield reliable outcomes. In this sense, trust in technology shares similarities with trust in humans, involving confidence in another entity's ability to meet one's expectations.

Trust plays a significant role in understanding users' acceptance and choice behaviors, as supported by numerous studies on AVs and EVs (Choi and Ji, 2015; Yuen et al., 2021b; Zhang et al., 2019). Lack of trust is reported as a major obstacle to drivers' willingness to use these emerging technologies. Trust is a dynamic concept that evolves over time, experiences, and knowledge. Zhang et al. (2020) argues that referring to initial trust, rather than trust, is more accurate because most consumers have not yet interacted with AVs. Similarly, UAM is still in its early stages, with Yavas (2023) describing the upcoming UAM service as a 'utopia'. While this may be an exaggeration, the fact remains that most consumers have not yet experienced UAM, suggesting that UAM may encounter similar trust-related challenges as AVs.

During the initial phase of UAM marketization, establishing initial trust among potential consumers is crucial. This helps overcome their perception of risk and develop a positive attitude towards UAM. Initial trust plays a vital role in reducing uncertainty and perceived risks. Li et al. (2008) proposed a research model for the formation of initial trust, encompassing factors such as trusting bases, beliefs, attitudes, subjective norms, and intentions. Given this, establishing initial trust in UAM is particularly important to ensure its success and cultivate a favorable attitude among potential users, ultimately influencing their adoption decisions. Consistent with previous research (Wang et al., 2022), this paper introduces initial trust into the original Technology Acceptance Model (TAM) and posits the following hypotheses:

H4a: Initial trust effect on perceived ease of use positively.

H4b: Initial trust effect on perceived usefulness positively.

H4c: Initial trust effect on the attitude towards using UAM positively.

2.2.4. Perceived risk

The psychological construct of perceived risk has garnered significant attention in social psychology research, particularly in consumer behavior. It is a multidimensional construct defined in various ways, with one prevailing definition characterizing it as the expected negative outcomes or costs that consumers associate with acquiring and utilizing a specific product or service. Essentially, perceived risk represents consumers' subjective evaluation of the potential dangers or disadvantages associated with a purchasing decision (Dunn et al., 1986).

Perceived risk is a crucial construct in behavioral research, as it can significantly influence consumers' decision-making and behavior. When adopting new technology, perceived risk is often a critical obstacle that must be addressed to promote acceptance. This is evident in research on the acceptance of AVs and EVs. The multidimensionality of perceived risk includes several dimensions, such as psychological, performance, financial, social, convenience, physical, and time-related risks. Therefore, understanding and managing perceived risk is essential for facilitating technology adoption and achieving successful outcomes.

In the context of UAM, perceived risk is particularly relevant as UAM is recognized as a disruptive and innovative technology that could revolutionize transportation. However, UAM involves air travel, and several concerns related to safety and usability can influence users' perceptions and attitudes towards this mode of transportation. These concerns may include bad weather conditions, noise pollution, and mechanical failures, as documented by various studies (Reiche et al., 2021). Previous research has shown that risk perception plays a crucial role in shaping individuals' attitudes and intentions towards adopting new technologies, and this holds true for UAM as well. The negative impact of perceived risks on technology acceptance, as measured by the TAM constructs, has been widely recognized. When risk perception is high, users may develop unfavorable attitudes and intentions towards using UAM. In this study, perceived risk is considered a determinant of initial trust in UAM. As suggested by previous research (Zhang et al., 2019), this paper proposes the following hypothesis:

H5: Perceived risk has a negative effect on the initial trust on UAM.

2.2.5. Technology belief

Belief plays a crucial role in understanding the world and providing explanations for various phenomena. The attitudes and beliefs held by users are key factors influencing their utilization of technology (Bhattacherjee and Premkumar, 2004). Although there is a shared intuitive grasp of the concept of belief, defining the term is not straightforward (Schacter and Scarry, 2001). According to the Shorter Oxford English Dictionary, belief is defined as "mental assent to or acceptance of a proposition, statement, or fact, as true, on the ground of authority or evidence." In psychology, belief is defined as a mental attitude or conviction that a particular idea or concept is true, real, or valid. These cognitive frameworks inform individuals' decisions, attitudes, and actions, making belief a vital component of human cognition.

The relationship between belief and behavior is well-established in academic research. Studies have demonstrated that individuals' beliefs about their capabilities, known as self-efficacy beliefs, influence their behavior and determine their level of effort and persistence in pursuing goals (Pajares, 1996; 2003; Zhu et al., 2020). Additionally, beliefs about the outcomes of specific behaviors, known as outcome expectations, also impact behavior. For instance, individuals are more likely to engage in a behavior if they believe it will lead to a positive outcome (Sexton and Tuckman, 1991). Furthermore, specific beliefs about technology affect users' acceptance of it. For example, Lewis et al. (2003) confirmed that beliefs significantly influence subsequent individual behaviors towards information technology. Li et al. (2019) found that teachers' pedagogical beliefs play a crucial role in predicting their use of technology. Moreover, Pivetti et al. (2021) revealed that respondents with strong conspiracy beliefs are less willing to accept the Covid-19 vaccine in Italy.

Technology, on the other hand, is the capacity to intentionally manipulate the environment to enhance one's likelihood of survival and overall living conditions, representing a fundamental characteristic of humans. In fact, technology has always been primarily driven by the trial and error of imagination (Wolpert, 2003). Many revolutionary technologies that once seemed unachievable eventually became reality after significant investments of time, money, and even lives. As these technologies become more widely adopted, users gradually form beliefs about them, based on their experiences, knowledge, and education. Technology belief is crucial for the adoption of technologies and can be measured by the degree to which people believe that technology can drive social development. Booth and Hunter (2018) has revealed the relationship between beliefs and trust. Therefore, it is hypothesized that:

H6: Technology belief has a positive effect on the initial trust on UAM.

Based on the above analysis, the proposed framework, illustrated in Fig. 3, elucidates the intention to use UAM.

3. Methods

3.1. Survey design

Based on the theoretical model presented above, a self-administered questionnaire consisting of three main sections was designed to gather empirical data and test the hypotheses. Since UAM has not been implemented yet, respondents had no prior experience

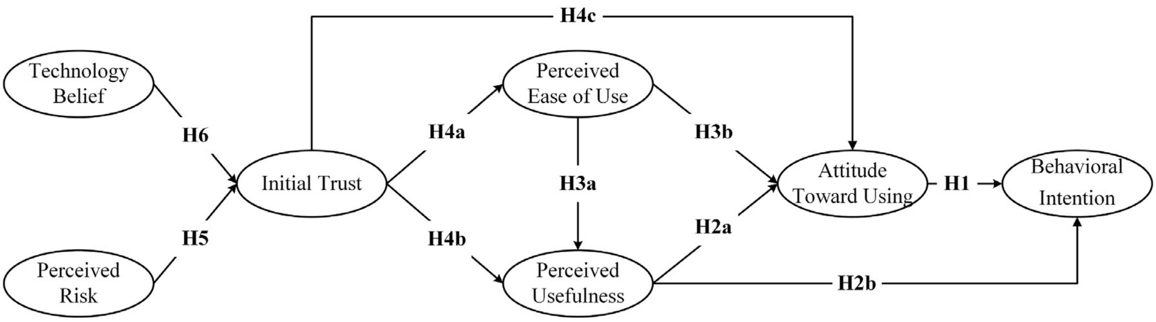

Fig. 3. The proposed UAM acceptance model.

Table 2
Construct and measurement items.

Constructs	Items	Questions	Sources
Behavioral intention	BI1	I expect to use UAM when it is commercially available.	(Zhang et al., 2019)
	BI2	I plan to use UAM when it is commercially available.	
	BI3	I intend to use UAM when it is commercially available.	
Attitude towards using	ATU1	I think that using UAM is a good idea.	(Davis, 1989)
	ATU2	I think that using UAM is a wise idea.	
	ATU3	I think that using UAM is pleasant.	
Perceived ease of use	PEU1	I think that using UAM will be convenient.	(Davis, 1989; Kim et al., 2022)
	PEU2	I think that learning to use UAM will be easy for me.	
	PEU3	I think that it would be simple for me if I use UAM.	
Perceived usefulness	PU1	I think that UAM will be useful in reducing traffic congestion.	(Davis, 1989)
	PU2	I think that UAM will be useful in reducing travel time.	
	PU3	I think that UAM will be useful in avoiding travel delays.	
	PU4	I think that UAM will be useful in enjoying the view from the air.	
	PU5	I think that UAM will be an effective way to travel.	
Initial trust	IT1	I think that UAM is dependable.	(Choi and Ji, 2015)
	IT2	I think that UAM is reliable.	
	IT3	Overall, I think that I can trust UAM.	
Perceived risk	PR1	I'm concerned that the bad weather would raise the risk from UAM.	(Zhang et al., 2020)
	PR2	I'm concerned that the failure of the UAM may have caused an accident.	
	PR3	I'm concerned that objects in the air (e.g. birds, balloons) may collide with UAM.	
	PR4	Overall, I'm concerned about the safety of UAM.	
Technology Belief	TB1	I think that technological progress is an important force for human development.	Self-developed
	TB2	I think that some technologies that seemed unachievable at first have eventually become reality.	
	TB3	I think people should actively try emerging technologies.	

or knowledge about it. Therefore, a brief introduction to UAM was provided at the beginning of the questionnaire in Part I. This introduction included images of advanced eVTOL vehicle such as Joby S4, as well as an explanation of the UAM infrastructure and the flying process. Additionally, a comprehensive definition of UAM was given, along with its technical features and potential market. The definition provided was as follows: *'Urban Air Mobility refers to a passenger-carrying air transportation system operating in the low-altitude airspace within urban areas. The implementation of UAM relies on a new type of transportation tool called electric vertical takeoff and landing aircraft, which uses vertical takeoff and landing, electric propulsion, and automatic piloting modes, with a capacity of carrying 2-4 passengers. In the future, passengers can book their trips in advance through mobile devices such as smartphones and aboard/alight at vertiports.'* Part II of the questionnaire focused on respondents' preferences and beliefs regarding UAM and contained measurement items for seven latent variables (PEU, PU, ATU, BI, IT, PR, TB). All items were measured using a five-point Likert-type scale, ranging from "strongly disagree (=1)" to "strongly agree (=5)." Table 2 shows the attitudinal statements designed and employed in the study and presented to respondents in a random order in the survey. To avoid any potential backlash from the respondents, demographic characteristics were measured in Part III, which was placed at the end of the questionnaire. Prior to conducting the full-scale survey, a pilot survey was conducted, indicating that respondents would take 3-8 minutes to complete the questionnaire.

3.2. Participants and data

To collect responses that are valid and representative, a formal online survey was conducted through the professional survey website Wenjuanxing (www.wjx.cn). The online questionnaire was available from January to February 2023. To ensure a substantial and diverse sample, the study utilized the official paid sample service and invited 612 respondents to participate in the survey. The IP addresses of these samples were from 29 provinces in China, with a focus on Beijing, Shanghai, and Guangdong. Data cleaning was carried out in three steps. Firstly, 26 samples were deemed unreliable as they were completed in less than 2 minutes. Secondly,

Table 3
Demographics.

Characteristics	Items	Number	Percentage
Gender	Male	276	50.74%
	Female	268	49.26%
Age	<18	12	2.21%
	18-25	84	15.44%
	26-30	193	35.48%
	31-40	176	32.35%
	41-50	42	7.72%
	51-60	27	4.96%
	>60	10	1.84%
Education	Middle school and below	13	2.39%
	High school	35	6.43%
	Junior college's degree	71	13.05%
	Bachelor's degree	299	54.96%
	Master's degree	105	19.30%
	Ph.D.	21	3.86%
Professional background[a]	Sciences	401	73.71%
	Liberal arts	143	26.29%
Monthly income (*CNY*)	<3,000	66	12.13%
	3,000-5,000	74	13.60%
	5,000-8,000	121	22.24%
	8,000-10,000	110	20.22%
	10,000-15,000	105	19.30%
	15,000-20,000	37	6.80%
	>20,000	31	5.70%
Valid samples		**544**	100.00%

[a] **Sciences** includes economics, science, engineering, military science, management, agriculture and medicine and interdisciplinary disciplines. **Liberal arts** includes philosophy, law, education, literature, history, art.

29 responses with identical answers were deleted. Thirdly, two pair inverse problems were included in Part II of the questionnaire to verify the validity of the samples. As a result, 13 samples were excluded due to the same attitude towards the two measurement items of inverse problems. After rigorous cleaning, a total of 544 usable responses were selected for analysis. Compared to other similar studies on emerging technologies (as shown in Table 1), the sample size is deemed appropriate for SEM studies (Wang et al., 2022).

3.3. Descriptive statistics

After collecting a sufficient number of valid samples, a summary of the respondents' demographic characteristics is presented in Table 3.

The gender distribution of the participants was nearly equal, with 50.74% being male. This resulted in a gender ratio of 102.98, which is slightly lower than the national average gender ratio of 104.98 in 2022. The majority of the participants were in the younger and middle age groups, between 18 and 40 years old, accounting for 83.27% of the sample. In terms of education level, a significant proportion of respondents (78.13%) had attained a bachelor's degree or higher. Regarding income level, approximately 61.76% of participants reported a monthly income between 5,000 *CNY* and 15,000 *CNY*. Only 42 respondents (7.7%) reported having heard of UAM before. In addition to typical demographic variables, this study also examined participants' professional backgrounds based on their highest level of education and associated academic discipline. In China, there are currently 14 discipline categories, which were categorized into two groups for this study: science and liberal arts. Findings indicate that approximately 75% of respondents come from a science professional background, while the remaining 25% have a liberal arts professional background. This distribution is consistent with the current situation in China, where there are more science students than liberal arts students.

In addition to demographic descriptive statistics, Fig. 4 displays the distribution of respondents' responses to attitude statements, while the mean value of each statement is presented in Table 4. Generally, respondents exhibit an open and positive attitude towards the emergence of UAM, with nearly 70% expressing a willingness to accept it. They recognize the usefulness and convenience of UAM but also acknowledge potential risks. Approximately 50% of respondents perceive an overall potential risk associated with UAM. Consequently, concerns about security reduce users' initial trust, with the average score for initial trust items averaging around 3.50. Regarding technology belief indicators, it is noteworthy that approximately 80% of respondents demonstrate a strong belief in technology.

4. Empirical results

In this paper, SEM was employed to assess the alignment of the survey data with the theoretical framework and to evaluate the proposed research hypotheses. SEM consists of two main components: Confirmatory Factor Analysis (CFA) to validate the measurement model, and Path Analysis (PA) to investigate the relationships among the constructs.

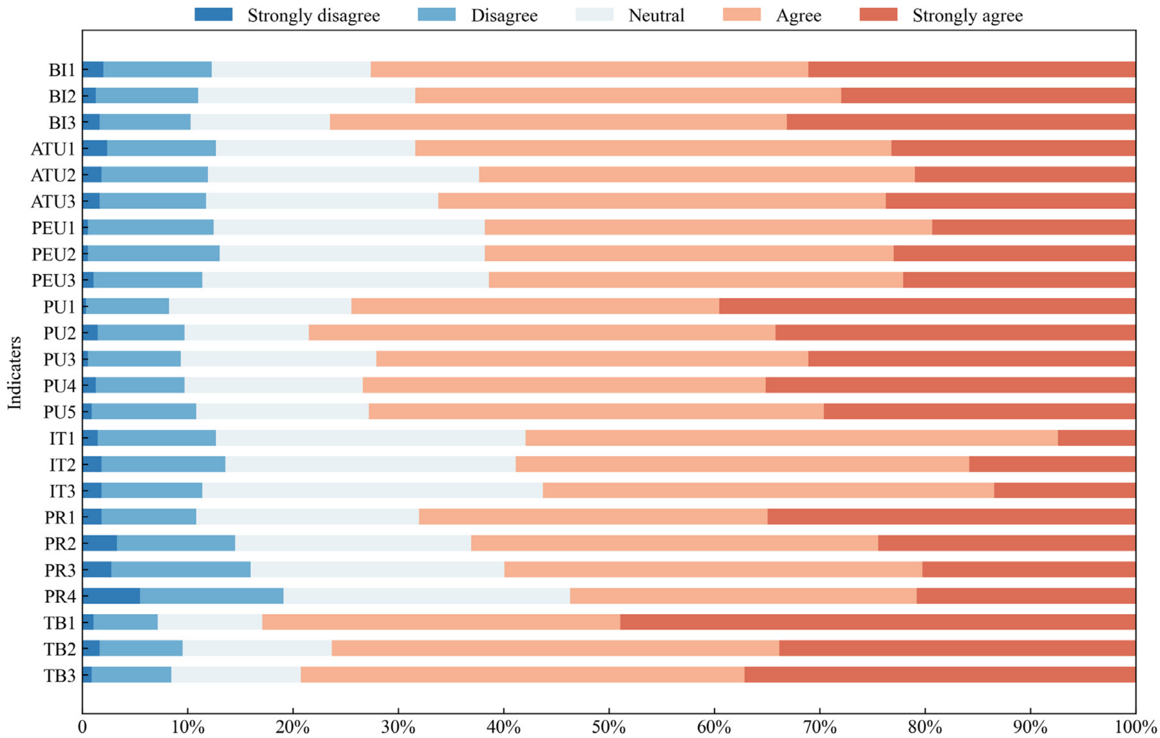

Fig. 4. Statistical distribution of personal attitude statements.

4.1. *Confirmatory factor analysis*

Since SEM relies on collected survey data, the subsequent analysis is meaningful only if the survey data exhibits high reliability and validity. Therefore, CFA is conducted to assess the reliability, validity, and goodness of fit of the model. Reliability refers to the extent to which a measurement consistently reproduces results, while validity concerns the degree to which the measurement accurately reflects the intended concept. Goodness-of-fit measures the degree of conformity between the model and the observed data. To evaluate the internal consistency of the measurement model, both Cronbach's α values and Composite Reliability (CR) values are calculated to assess construct reliability. Cronbach's α is a coefficient ranging from 0 to 1, where a value of 1 indicates perfect reliability (Cronbach, 1951). Composite Reliability (CR) is another measure of internal consistency and serves as an extension of Cronbach's α (Raykov, 1997). When both Cronbach's α and CR values exceed 0.7, it generally indicates good internal consistency (Fornell and Larcker, 1981). To evaluate convergent validity, the congruence among multiple indicators of a unified construct is assessed. This evaluation involves examining Factor Loadings (FL) and Average Variance Extracted (AVE).

FL refers to the correlation between an observed variable and its latent variable. It indicates the extent to which each indicator contributes to the construct it is intended to measure. High factor loadings suggest that the indicator is effective in representing the construct. AVE is a measure of the amount of variance captured by the construct relative to the amount of variance due to measurement error. It is calculated as the average of the squared factor loadings for all indicators defining a construct (Hair Joseph et al., 2010). When the FL for each indicator on its respective construct exceeds a threshold of 0.6, and the AVE for each construct surpasses 0.5, the proposed model can be considered to exhibit strong evidence of convergent validity (Ab Hamid et al., 2017). The assessment results for reliability and convergent validity are presented in Table 4.

Furthermore, the paper evaluates discriminant validity by comparing the square root of the AVE for each construct to the inter-construct correlation coefficients. In Table 5, the diagonal elements, which represent the square root of AVE, are notably larger than the off-diagonal elements, which denote the correlation coefficients between different constructs. This pattern suggests that the measurement model exhibits strong discriminant validity.

Based on the data presented in the aforementioned tables, all results met the threshold criteria, indicating that the model exhibits strong convergent validity, reliability, and discriminant validity.

Upon establishing the validity and reliability of the constructs, we proceeded to evaluate the overall fit of the UAM-AM model using a comprehensive set of goodness-of-fit indices that are well-established in the literature (Mulaik et al., 1989; Wang et al., 2020; Zhang et al., 2020). These included the ratio of the Chi-square value to degrees of freedom (χ^2/df), the Goodness-of-Fit Index (GFI), the Adjusted Goodness-of-Fit Index (AGFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR), which quantify the discrepancy between the model and the observed data. Furthermore, we also utilized the Normed Fit Index (NFI), Comparative Fit Index (CFI), Parsimony Goodness-of-Fit Index (PGFI), and the Parsimony Adjusted Normed

Table 4
Convergent validity and reliability.

Constructs	Items	Means	Reliability		Convergent validity	
			Cronbach α	CR	FL	AVE
Behavioral intention	BI1	3.893	0.821	0.893	0.868	0.736
	BI2	3.840			0.842	
	BI3	3.976			0.864	
Attitude towards using	ATU1	3.765	0.820	0.875	0.867	0.701
	ATU2	3.695			0.812	
	ATU3	3.765			0.831	
Perceived ease of use	PEU1	3.680	0.741	0.853	0.770	0.659
	PEU2	3.711			0.836	
	PEU3	3.710			0.828	
Perceived usefulness	PU1	4.053	0.801	0.863	0.778	0.557
	PU2	4.015			0.729	
	PU3	3.932			0.731	
	PU4	3.974			0.712	
	PU5	3.906			0.779	
Initial trust	IT1	3.511	0.797	0.882	0.862	0.714
	IT2	3.592			0.848	
	IT3	3.564			0.825	
Perceived risk	PR1	3.903	0.863	0.907	0.804	0.709
	PR2	3.697			0.862	
	PR3	3.614			0.848	
	PR4	3.498			0.854	
Technology belief	TB1	4.235	0.784	0.874	0.853	0.698
	TB2	3.989			0.821	
	TB3	4.070			0.833	

Table 5
Correlation matrix of seven latent variables.

Construct	BI	ATU	PU	PEU	IT	PR	TB
BI	**0.859**						
ATU	0.811	**0.837**					
PU	0.696	0.673	**0.746**				
PEU	0.548	0.611	0.652	**0.812**			
IT	0.726	0.778	0.553	0.506	**0.845**		
PR	-0.059	-0.159	-0.075	-0.081	-0.185	**0.842**	
TB	0.631	0.530	0.648	0.514	0.508	-0.202	**0.836**

The figures highlighted in bold represent the square roots of AVE values.

Table 6
Goodness-of-fit indices of CFA.

Fitness index	Index value	Ideal value
Absolute fit measure		
χ^2/df	2.334	<3.000
GFI	0.924	>0.900
AGFI	0.906	>0.900
RMSEA	0.050	<0.080
SRMR	0.077	<0.080
Parsimony fit measure		
PGFI	0.739	>0.500
PNFI	0.799	>0.500
Incremental fit measure		
NFI	0.911	>0.900
CFI	0.942	>0.900

Notes: This table refers to the literature by Wang et al. (2020).

Fit Index (PNFI) to evaluate the model's fitness (Marsh and Balla, 1994; Williams and Holahan, 1994). NFI and CFI are incremental fit indices that compare the proposed model to a null model, while PGFI and PNFI are parsimony-based indices that account for the complexity of the model. The threshold criteria for each of above indices were derived from prior scholarly work and were applied to rigorously assess the model's fit (Wang et al., 2020). The results for each indice are presented in Table 6, which shows that all of these goodness-of-fit indices meet the recommended level.

Therefore, the analysis can be summed up as proving a good model fit.

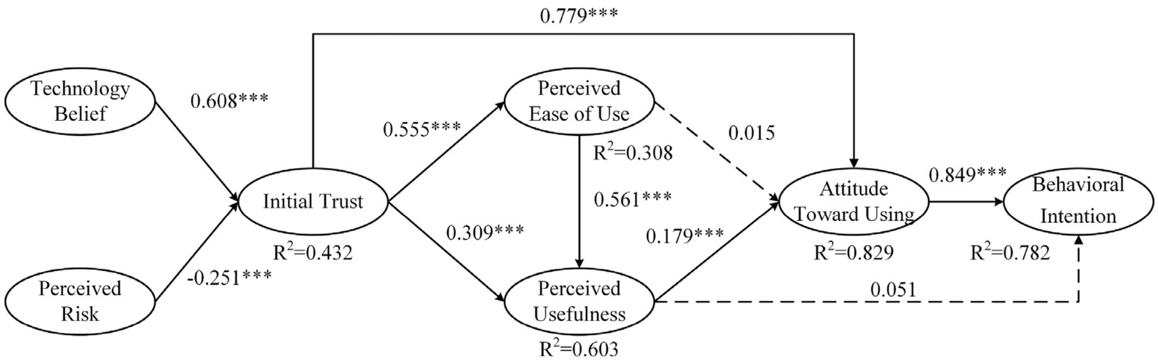

Fig. 5. Results of path analysis.

Table 7
Results of the hypothesis.

Hypothesis	Path	Coefficient	t-Value	Significance	Accepted or not
H1	ATU→BI	0.849	13.119	***	Yes
H2a	PU→ATU	0.179	2.528	***	Yes
H2b	PU→BI	0.051	0.902		No
H3a	PEU→PU	0.561	7.983	***	Yes
H3b	PEU→ATU	0.015	0.229		No
H4a	IT→PEU	0.555	9.221	***	Yes
H4b	IT→PU	0.309	5.086	***	Yes
H4c	IT→ATU	0.779	11.920	***	Yes
H5	PR→IT	-0.251	-5.552	***	Yes
H6	TB→IT	0.608	10.414	***	Yes

*t-value < 0.05, **t-value < 0.01, ***t-value < 0.001.

4.2. Path analysis

After confirming the model fit, the study proceeded with path analysis to test the proposed hypotheses and examine the relationships between variables. The analysis evaluated the size, direction, and significance of the standardized path coefficients, with results presented in Fig. 5. To enhance clarity, significant paths are illustrated with solid lines, while non-significant paths are depicted with dotted lines. Additionally, Table 7 summarizes the path coefficients and the outcomes of the hypothesis testing, providing a detailed overview of the strength, direction, and statistical significance of the relationships between variables in the model.

Firstly, this research focuses on the basic relationships derived from the original TAM (H1, H2a, H2b, H3a, H3b). The analysis revealed that ATU has a strong positive effect on BI (β = 0.849, t-value = 13.119), supporting Hypothesis H1. PU significantly affects ATU (β = 0.179, t-value = 2.528), confirming Hypothesis H2a. Additionally, PEU positively influences PU (β = 0.561, t-value = 7.983), which supports Hypothesis H3a. However, the effects of PU on BI (β = 0.051, t-value = 0.902) and PEU on ATU (β = 0.015, t-value = 0.229) are not significant, leading to the rejection of Hypotheses H2b and H3b. This finding is consistent with some previous research, which suggests that PU may not directly affect BI but can influence BI indirectly through ATU (Wang et al., 2022). The study then explored the relationships between the extended variables (IT, PR, and TB) and the basic TAM variables (PU, PEU, ATU, BI). Results indicate a positive correlation between IT and the key acceptance factors: PEU, PU, and ATU. Specifically, IT has a greater positive impact on ATU (β = 0.779, t-value = 11.920) compared to PEU (β = 0.555, t-value = 9.221) and PU (β = 0.309, t-value = 5.086). These findings support Hypotheses H4a, H4b, and H4c, which posit that IT positively affects users' acceptance of UAM through PEU, PU, and ATU. Furthermore, the study confirms Hypothesis H5, which predicts a negative relationship between IT and PR. The beta coefficient and t-value (β = -0.251, t-value = -5.552) indicate that PR adversely impacts IT. TB positively and directly affects IT, supporting Hypothesis H6 (β = 0.608, t-value = 10.414).

In Fig. 5, the R^2 values for BI, ATU, PEU, PU, and IT were 0.782, 0.829, 0.308, 0.603 and 0.432, respectively. The R^2 indicates the extent to which the corresponding construct can be significantly explained by other constructs that are significantly related. For example, 43.2% of variance in initial trust can be explained by technology belief and perceived risk. Based on the suggestions from Falk and Miller (1992), an appropriate R^2 value should be over than 0.1.

4.3. Acceptance and technology belief differences

In this study, an independent-samples T-test was conducted to determine whether there were significant differences in acceptance and technology belief between different groups, specifically males and females, and between liberal arts and science backgrounds. Users' acceptance was measured using the construct behavioral intention. Before performing the T-test, the behavior intention and

Table 8
T-test results for differences between males and females, sciences and liberal arts groups.

Construct	Attributes	Gender		Professional background	
		Male(N=276)	Female(N=268)	Sciences(N=401)	Liberal arts(N=143)
BI	mean	3.93	3.87	3.99	3.65
	st.d	0.83	0.87	0.79	0.94
	t-value	0.80		4.18***	
	p-value	0.43		0.00	
TB	mean	4.07	4.12	4.18	3.88
	st.d	0.79	0.78	0.71	0.89
	t-value	-0.79		3.90***	
	p-value	0.93		0.00	

technology belief scores were calculated as the average of their respective items. Levene's tests were conducted to assess the equality of variances between the two groups.

As shown in Table 8, the results revealed no statistically significant difference in the meanbehavioral intention values between males and females (t-value = 0.80, p-value = 0.43), suggesting that gender does not influence UAM acceptance. Similarly, the results for TB were not statistically significant (t-value = -0.79, p-value = 0.93), indicating no discernible difference in technology belief between males and females. Although the mean values differed, the lack of significance implies that any observed differences were likely due to sampling variations or random chance.

As for professional background, the t-values for the constructs of behavioral intention and technology belief were 4.18 and 3.90, respectively, both exceeding the significance level of 0.01 (t-value > 1.96). This indicates a significant difference in BI and TB between individuals from liberal arts and science backgrounds. The mean values suggest that individuals with a science background have a higher technology belief (mean = 4.18 vs. 3.88) and are more inclined to accept UAM (mean = 3.99 vs. 3.65). These results support the assertion that professional background significantly influences technology belief and behavioral intention. In China, individuals with a science background frequently engage with mathematical and physical courses. Research has shown that there are significant differences in mathematics proficiency between liberal arts and science students, with science students exhibiting superior data processing and spatial reasoning skills (Ren et al., 2015). This expertise contributes to a stronger technology belief and has a lasting impact on their attitudes toward adopting new technologies such as UAM.

5. Discussion

Urban Air Mobility (UAM) represents a groundbreaking advancement in transportation. However, the level of public acceptance of this technology has been inadequately addressed in existing literature. This study seeks to address this gap by developing a conceptual framework that investigates the factors influencing public acceptance of UAM. Building on the TAM, this research examines the relationships among various constructs, including Initial Trust (IT), Perceived Risk (PR), Technology Belief (TB), Perceived Ease of Use (PEU), Perceived Usefulness (PU), Attitude Toward Using (ATU), and Behavioral Intention (BI). The study hypothesizes that the adoption of UAM is affected not only by users' positive perceptions, such as perceived ease of use and perceived usefulness, but also by negative perceptions, as captured by perceived risk. The findings offer robust empirical support for the proposed model, indicating that initial trust is the most significant predictor of user attitude toward UAM. These insights have important implications for both theoretical advancements in technology acceptance research and practical considerations in transportation policy and service design.

5.1. *Theoretical implications*

The theoretical implications of this paper are reflected in three key aspects. Firstly, this study significantly contributes to the literature by validating the TAM within the context of UAM acceptance. This paper is among the few that have employed TAM to examine users' acceptance intentions for UAM, a novel technology poised to transform the transportation industry. Consistent with the original TAM hypotheses, the study confirmed the substantial roles of perceived ease of use and perceived usefulness in influencing users' attitude toward using UAM and behavioral intention to use UAM. Specifically, perceived ease of use positively impacted perceived usefulness, which, in turn, positively affected attitude toward using UAM. However, it is noteworthy that two foundational assumptions of TAM did not hold in the empirical analysis. While this result might seem discouraging, it is not entirely surprising, as similar findings have been observed in other research areas. Importantly, this does not diminish the significant explanatory power of TAM in understanding technology acceptance. The lack of practical application and users' limited experience with UAM might have contributed to the unclear impact of perceived ease of use. In summary, this study provides robust evidence that TAM remains a valid model for explaining technology acceptance across various contexts, including UAM. Additionally, the study advances our understanding of technology acceptance and lays the groundwork for future research in this domain.

Secondly, the findings of this study make a significant contribution to the existing literature on user acceptance of UAM by confirming the crucial role of initial trust in shaping user attitudes toward this emerging technology. This contribution is particularly notable as it represents the first empirical evidence highlighting the primacy of initial trust over other determinants of acceptance, such as perceived usefulness and perceived ease of use. The results align with previous studies on AVs (Choi and Ji, 2015; Zhang et al., 2019), which also identified initial trust as a key determinant of usage intention. However, this study extends beyond prior research by demonstrating that initial trust is the most influential factor in shaping user attitudes toward UAM (Kim et al., 2022). The impact of initial trust on user attitudes toward UAM was found to be substantially stronger than that of perceived usefulness and perceived ease of use, underscoring initial trust as the primary driver of acceptance. Theoretically, these findings provide a significant advancement in the literature on UAM and technology acceptance by emphasizing initial trust's critical role. They have important implications for the design and implementation of UAM systems and reinforce the importance of initial trust in shaping user attitudes toward emerging technologies.

The third significant contribution of this study is the introduction of the concept of technology belief, which is utilized to explore the relationship between initial trust and perceived risk, extending the existing automation trust models (Hoff and Bashir, 2015; Lee and See, 2004). To our knowledge, this is the first application of technology belief within the TAM. Technology belief is defined as a belief that users develop based on their experiences, knowledge, and education, resembling pedagogical or conspiracy beliefs as discussed in the literature (Li et al., 2019; Pivetti et al., 2021). Although users may initially lack understanding and experience with emerging technologies like UAM, a strong technology belief can enhance their initial trust and mitigate the impact of perceived risk. In essence, users with a robust technology belief are better equipped to resist external influences that may affect their beliefs and opinions about new technologies. Furthermore, the study found significant differences in technology belief between individuals from different professional backgrounds, with those from a sciences background exhibiting a stronger technology belief compared to their liberal arts counterparts. This result indicates that technology belief is not a universal construct but varies across different demographic groups. The introduction of technology belief as a novel construct in the context of TAM represents a substantial theoretical advancement in technology adoption research. Understanding the role of technology belief in shaping users' beliefs and attitudes toward new technologies can aid researchers and practitioners in developing more effective strategies to encourage the adoption and use of such technologies.

5.2. Practical implications

Based on the UAM-AM model proposed in this study, we offer several practical recommendations for eVTOL developers, UAM service providers, and policymakers. The results of the path analysis underscore the pivotal role of initial trust in shaping public acceptance, demonstrating its most significant positive impact. To foster greater public acceptance of UAM, it is crucial to enhance initial trust. According to the model, two primary strategies can be employed: reducing users' perceived risk and strengthening their technology belief. Additionally, improving perceived usefulness through perceived ease of use can further increase users' willingness to adopt UAM. eVTOL developers are currently the most crucial and active stakeholders in the UAM ecosystem, tasked with the design and production of eVTOL vehicles. While focusing on the development process, eVTOL developers should also ensure timely public engagement by presenting detailed information on eVTOLs, including performance parameters, technical and economic indicators, and safety features such as multi-rotor configurations, battery backups, and parachutes. Furthermore, developers should organize promotional flight demonstrations of eVTOLs and, where feasible, offer opportunities for the public to participate in flight experiences. These initiatives are essential for enhancing users' initial trust in UAM by mitigating perceived risks.

UAM service providers will be central to the UAM system during the forthcoming commercial operation phase, responsible for designing and delivering specific services. To enhance the perceived ease of use for users, these providers should implement a comprehensive and seamless door-to-door travel service, thereby simplifying the decision-making process for users. For example, offering complimentary and timely shuttle services at the access and egress of vertiports can significantly improve user convenience. Additionally, by utilizing media promotional tools such as TikTok, providers can raise awareness about the positive societal and community impacts of UAM services, including reductions in pollution, alleviation of congestion, and creation of employment opportunities. Such efforts can thereby enhance the perceived usefulness of UAM services.

Policymakers play a crucial role in the UAM system, serving as regulators and guides. Firstly, as eVTOLs are a primary source of perceived risk for users, it is essential for policymakers to establish stringent standards to assess whether eVTOLs meet operational requirements and to promptly communicate these assessment outcomes to the public. Secondly, policymakers should work closely with industry stakeholders and academic experts to develop service specifications and operational guidelines for UAM services. Lastly, policymakers should promote and support higher education in fields such as mathematics, physics, and chemistry, which are vital for developing logical and analytical skills. This will enhance students' understanding of technology and foster a strong technology belief. Although cultivating such a belief is a long-term process that requires experience, knowledge, and time, a strengthened technology belief will not only positively impact the future promotion of UAM but also facilitate the broader adoption of advanced technologies.

5.3. Limitations and future work

The findings of this research are both thought-provoking and significant, offering valuable theoretical and practical implications.However, acknowledging the study's limitations is crucial for guiding future research. One major limitation stems from the use of online surveys due to restrictions imposed by the Covid-19 pandemic. While this method was practical, it may not fully capture the comprehensive process through which potential users evaluate UAM as a viable transportation option compared to existing urban transit modes. Future research should incorporate additional methodologies, such as focus group interviews or laddering techniques, to enrich the findings.

Another limitation is the lack of actual experience with UAM among participants. This absence means that some participants might perceive UAM as a speculative concept rather than a tangible transportation option. As more eVTOLs are developed and users gain firsthand experience with UAM, attitudes and behavioral intentions may evolve, similar to the current evolution of AVs. Therefore, ongoing studies are necessary as UAM becomes more prevalent to assess its impact and user perceptions.

Furthermore, future research should consider conducting studies across different cultures, countries, and geographies. Such cross-cultural research would provide a more comprehensive understanding of UAM acceptance across diverse populations and contexts. While this research presents intriguing results, addressing these limitations in future studies is essential to fully understand the potential of UAM as a transportation option.

6. Conclusion

By incorporating initial trust, perceived risk, and technology belief, this study has proposed and empirically tested an Urban Air Mobility Acceptance Model (UAM-AM) to better understand users' attitudes and behavioral intentions towards the emerging UAM technology. Based on the UAM-AM framework, the study hypothesized and confirmed that technology belief and perceived risk collectively shape initial trust, which in turn influences attitudes and behavioral intentions to use UAM, with perceived usefulness and ease of use playing mediating roles. The research involved a widespread online survey, collecting 544 valid responses from China between January and February 2023 for hypothesis testing. The results reveal that while perceived ease of use positively affects perceived usefulness, it does not significantly impact the intention to use UAM, contrary to initial expectations. Initial trust is identified as a crucial factor in understanding public acceptance of UAM, aligning with findings from previous studies on AVs. Notably, initial trust is determined by perceived risk and technology belief, a new construct introduced for the first time in this study. An intriguing finding is that individuals with a science background exhibit a stronger technology belief compared to those with a liberal arts background, leading to greater receptivity towards UAM. This research not only enriches the literature on UAM adoption by elucidating the mechanisms between psychological factors and acceptance but also contributes to TAM literature by integrating technology belief into TAM. Additionally, the study proposes practical strategies and policies aimed at improving overall UAM acceptance based on the validated UAM-AM.

Declaration of competing interest

None.

CRediT authorship contribution statement

Enjian Yao: Writing – review & editing, Software, Methodology, Funding acquisition, Data curation, Conceptualization. **Dongbo Guo:** Writing – original draft, Visualization, Software, Project administration, Methodology, Data curation, Conceptualization. **Shasha Liu:** Writing – original draft, Visualization, Validation, Resources, Methodology, Investigation, Funding acquisition, Data curation. **Junyi Zhang:** Writing – review & editing, Validation, Funding acquisition.

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